

**Page Denied**

25 YEAR RE-REVIEW

## HAMILTON STANDARD

SPEC. NO. HS 2097

DIVISION OF UNITED AIRCRAFT CORPORATION

CODE IDENT NO. 73030

WINDSOR LOCKS, CONNECTICUT, U. S. A.

PAGE 2 OF

1. GENERAL INFORMATION1.1 Scope

This specification covers the method for testing the model JFC51 Afterburner Fuel Control 579400.

1.2 Equipment Required

Flow bench with a boost pump capable of supplying 10-70 psig fuel pressure to the main pumps in a closed loop system of operation. Main pumps capable of supplying 65000 PPH at 1000 psig pump discharge pressure. Two metered flow meters; Zone I and Zone II. Zone I meter must be accurate to 0.5% in the 3000 PPH to 50000 PPH range and the Zone II meter must be accurate to 0.5% in the 1500-25000 PPH range. A recirculation line flowmeter accurate to 1.0% in the 350-5000 PPH range. An internal leakage flowmeter accurate to 2.0% in the 350-3000 PPH range. Pump discharge pressure to be controlled as a function of pump controller output thru a system of relief valves in pump discharge line.

1.2.1 Test fluid will be PMC 9073. Maintain control inlet and flowmeter inlet at  $100^{\circ} \pm 5^{\circ}\text{F.}$  except as specified for hot testing.

1.2.2 Pneumatic pressure source and two gages for simulating engine burner pressure capable of maintaining for a minimum period of 0.5 hour any pressure between 10 and 300 PSIA. One gage 0 to 500 psia accurate to  $\pm 0.25$  psia. One gage 0 to 300 psia accurate to  $\pm 0.25$  psia over a range of 50 to 300 psia.

1.2.3 Constant temperature baths capable of maintaining temperature of  $-65^{\circ}$ ,  $0^{\circ}$ ,  $+59^{\circ}$ , and  $+150^{\circ}$  within  $\pm 5^{\circ}\text{F.}$

1.2.3.1 Temperature equipment to maintain temperature from  $+150^{\circ}\text{F.}$  to  $+950^{\circ}\text{F.}$  during hot testing. Temperatures to be accurate within  $\pm 10^{\circ}\text{F.}$

1.2.4 Thermocouple and indicating unit with  $\pm 3^{\circ}\text{F.}$  accuracy for measuring temperatures between  $-65^{\circ}\text{F.}$  to  $+300^{\circ}\text{F.}$  and with  $\pm 5^{\circ}\text{F.}$  accuracy between  $+300^{\circ}\text{F.}$  and  $950^{\circ}\text{F.}$

1.2.5 Temperature cam calibration follower and dial indicator 560000 ET-7.

1.2.6 Gages for taking the following measurements within the specified accuracy.

1. Control proof pressure 0-1500 psi with 1.0% accuracy of full scale reading.
2. Control inlet pressure ( $P_{in}$ ): 0-1000 psi with 1.0% accuracy of full scale reading.

HAMILTON STANDARD  
DIVISION OF UNITED AIRCRAFT CORPORATION  
WINDSOR LOCKS, CONNECTICUT, U. S. A.

SPEC. NO. HS 2097  
CODE IDENT NO. 73030  
PAGE 3 OF

1.2.6 (continued)

3. Control outlet pressure ( $P_{out}$ ): Two gages Zone I and Zone II: 0-1000 psi with 1.0% accuracy of full scale reading.
4. Control body pressure ( $P_{ob}$ ): 0-150 psi with 1.0% accuracy of full scale reading.
5. Total flow throttle valve differential gage ( $\Delta PTFTV$ ): 0-80 psi with .75% accuracy of full scale reading.
6. Peak flow throttle valve differential gage ( $\Delta PPFTV$ ): 0-150 psi with .75% accuracy of full scale reading.
7. Pump controller differential gage: 0-200 psi with .75% accuracy of full scale reading.
8. Rig boost pressure ( $P_{rb}$ ): 0-100 psi with 1.0% of full scale reading.
9. Spare Gages:
  1. 0-600 psi with 0.5% accuracy of full scale reading.
  2. 0-800 psi with 1.0% accuracy of full scale reading.
  3. 0-1000 psi with 1.0% accuracy of full scale reading (2 gages),

1.2.7 Separate pressure source capable of supplying 200 pph at fuel pressures of 50-750 psig.

1.2.8 Provisions for testing the control at +350°F. fuel temperature.

1.2.9 Back pressure schedule as indicated in Appendix D-1.

1.2.10 Sanborn Recorder.

1.2.11 X-Y coordinate plotter.

1.2.12 Angular position indicator to supply pump control output shaft position input to Sanborn recorder.

1.2.13 Preliminary Checks

1.2.13.1 The fuel control shall be assembled using the shimming procedures in HS 1594. The procedure is to act as a guide only, and may be varied as necessary to satisfy control calibration flow schedule requirements.

1.3 Test Requirements

1.3.1 The following readings shall be recorded at each calibration point.

1. Total metered fuel flow . . . . . Wft
2. Absolute burner pressure . . . . . PB

HAMILTON STANDARD SPEC. NO. HS 2097  
DIVISION OF UNITED AIRCRAFT CORPORATION CODE IDENT NO. 73030  
WINDSOR LOCKS, CONNECTICUT, U. S. A. PAGE 4 OF

1.3.1 (continued)

3. Inlet bulb temperature . . . . .  $T_{T2}$
4. Power lever angle . . . . . PLA
5. Compressor bleed position . . . . . CBA
6. Throttle valve differential . . . . .  $TV\Delta P$
7. Pump controller differential . . . . .  $PC\Delta P$

1.3.2

The following readings shall be recorded at the beginning and end of the variable input during calibration.

1. Control inlet pressure . . . . . PSIG . . . . .  $P_{in}$
2. Control outlet pressure . . . . . PSIG . . . . .  $P_{out}$
3. Test fluid temperature . . . . .  $^{\circ}F$ .
4. Control body pressure . . . . . PSIG . . . . .  $P_{cb}$

1.3.3

The following readings shall be recorded when noted:

1. Zone I fuel flow . . . . .  $W_{f1}$
2. Zone II fuel flow . . . . .  $W_{f2}$
3. Peak fuel flow . . . . .  $W_{fp}$
4. Arming signal . . . . . PSIG
5. Transfer Point . . . . .  $W_f$  and  $PB$
6. Pressure in recirculation line . . . . . PR

1.3.4

The following abbreviations, in addition to the foregoing are used in this specification:

1. Clockwise . . . . . CW
2. Counterclockwise . . . . . CCW
3. Military PLA . . . . . MAX (wide open throttle)

1.3.5

Accuracy of settings:

1. PB settings shall be held exact
2.  $T_{T2}$  settings shall be held to  $\pm 5^{\circ}F$ .
3.  $W_f$  shall be read exact.



2. INSPECTION REQUIREMENTS

2.1 The items marked with an asterisk (\*) in this specification are inspection items and as such must be under inspection surveillance.

2.2 Retest Requirements: If settings listed under "Reset" are re-adjusted or if assemblies or parts listed under "Replace" are replaced or removed for repair, the settings listed under corresponding "Retest" must be retested and settings not yet tested must be completed.

Reset

PB Servo (8.0)  
Temperature Servo (9.0)  
Total Flow T.V. (10.0)  
Zone II Transfer (12.0)  
Power Lever (6.1)

Retest

14.1.1, 14.2.1, 14.4.1, 14.4.2  
14.1.1, 14.4.1, 14.4.2  
14.1.1, 14.2.1, 14.4.1, 14.4.2  
14.5.1, 14.5.2  
6.2, 6.3

Replace

Servo Housing  
Temperature Servo  
Transfer Housing  
Zone I Outlet Housing  
Zone II Outlet Housing  
Pump Controller

Retest

8.0, 14.1.1, 14.2.1, 14.4.1, 14.4.2  
9.0, 14.1.1, 14.4.1, 14.4.2  
12.0, 14.5.1, 14.5.2  
14.8.2.1, 14.8.2.2  
14.6.1, 14.8.1.3, 14.8.2.1, 14.8.2.2  
7.1, 7.2.1, 7.2.2

2.3 No adjustments or changes in parts shall be permitted during the final, inspected, test of the control.

3. INSTALLATION INSTRUCTIONS

3.1 Install control on drain table in a position similar to normal engine mounted position (Ref. P&WA layout 203578), connect Pump Discharge to control inlet, both outlets must be connected to separate flowmeters. Recirculation and internal leakage lines must also be connected to separate flowmeters.

3.2 Install 80 psi differential gage across the total flow throttle valve, 150 psi across peak throttle valve, also install 200 psi differential gage across the total flow T.V. and inline regulator.

3.3 Install a separate fuel pressure source to the speed signal valve.

3.4 Make sure that there are no open fittings on control and the internal leakage line is not "dead headed".

3.5 The flowmeter density adjustments shall be set in accordance with actual density measurements during both ambient and hot fuel tests.

HAMILTON STANDARD

SPEC. NO. HS 2097

DIVISION OF UNITED AIRCRAFT CORPORATION

CODE IDENT NO. 73030

WINDSOR LOCKS, CONNECTICUT, U. S. A.

PAGE 6 OF

4. EXTERNAL LEAKAGE

4.1 With PLA at Max A/B, set boost pump pressure to  $60 \pm 15$  psig. There shall be no external leakage except:

- a) No more than 10 DPM from the PB drain.
- b) No more than 30 DPM from the Pump Controller Drain.

The term "no leakage" shall be defined as the permissible visual appearance of fluid on the external surface of a control which does not become progressively greater during a 5 minute period to such a degree that fluid runs off the surface of the control or forms droplets.

5. PROOF PRESSURE TEST

\* 5.1 With PLA at max., increase WF to  $10,000 \pm 500$  PPH. Close outlet valve until Pin is  $1500 \pm 20$  psi. Maintain this pressure for a time period not to exceed 1 minute. There shall be no external leakage. Open outlet valve. The term "no leakage" shall be applied as defined in paragraph 4.1.

6. POWER LEVER SEQUENCE

6.1 Increase power lever angle until a position is reached where the PL Servo Piston moves .001-.005. Lock PL in place and adjust protractor slip ring until it reads  $67^\circ$ . At this position adjust the stop plate until the hole in the stop plate lines up with the slot in the index ring. Be sure protractor slip ring and stop plate are locked in position.

CAUTION: Be sure PL servo piston is not hitting the min. line stop (cover or screw in cover) when finding the .001 - .005 motion position. Check by turning PL position adj. screw until servo moves at least .020.

6.2 Set PLA = Max, PB = 15 psia. Decrease PLA to  $0^\circ$ . Apply 150 psig to speed signal valve. Increase PLA to  $67^\circ$ . Adjust TOPV cam until the recirculation valve closes and the Zone I S.O.V. is open.

CAUTION: Torque on adjusting screws to be 15-20 in-lbs.

7. PUMP CONTROLLER CALIBRATION

7.1 Set PLA = max., PB = 18 psia. Adjust spring pre-load on pilot valve until P1 - P3 is  $100 \pm 2$  psi. Repeat at PB = 50 and 100 psia differential pressure must remain at  $100 \pm 5$  psi.

7.2 Dynamic Performance

\* 7.2.1 Integral Rate

HAMILTON STANDARD  
DIVISION OF UNITED AIRCRAFT CORPORATION  
WINDSOR LOCKS, CONNECTICUT, U. S. A.

SPEC. NO. HS 2097

CODE IDENT NO. 73030

PAGE 7 OF

- 7.2.1.1 Disconnect the pump control shaft from the stand output flow control. Install the fixtures necessary to make Sanborne traces of pump control output shaft angle and  $\Delta P(1-3)$ . Set PLA at  $120^\circ$ ,  $T_{T2}$  at  $+59^\circ F.$ , PB at 100 psia, bleeds closed.
- 7.2.1.2 Adjust the stand output flow control to create a  $\Delta P(1-3)$  of 105 psi. When P.C. output shaft is near the center of its stroke make a step change to decrease  $\Delta P(1-3)$  such that it is 5 to 9 psi below the P.C. setting. Obtain at least two Sanborne recordings of this transient.
- 7.2.1.3 Put P.C. output shaft near the center of its stroke by varying  $\Delta P(1-3)$ , then make a step change to increase  $\Delta P(1-3)$  such that it is 5 to 9 psi above the P.C. setting. Get Sanborne recordings of this transient.
- 7.2.1.4 The integration rate of the P.C. output shaft shall be between 0.1 and 0.3 degrees per psi error per second.

\* 7.2.2 Slew Rate Position

Disconnect Pump Controller Shaft from stand output flow control. Set PLA at Max.,  $T_{T2}$  at  $+59^\circ F.$ , Pb at 100 psia, bleeds closed, adjust stand output flow to decrease  $\Delta P(1-3)$  the amount necessary to cause the Pump Controller Arm to move at its "Slew Rate".  $\Delta P(1-3)$  to get this slew rate shall be 18 to 22 psi below the Pump Controller setting. Shim under proportional piston spring to meet this requirement (Ref. Figure 31, H.S.1594). Maximum number of shims shall not exceed .130. If maximum shim thickness is exceeded, replace spring under the feedback piston with a lower dash numbered spring.

\* 7.2.3 Slew Rate

Disconnect pump controller shaft from stand output flow control. Set PLA at Max.,  $T_{T2}$  at  $+59^\circ F.$ , Pb at 100 psia, bleeds closed; adjust motor control to create  $\Delta P(1-3)$  of 105 psi. Obtain a transient recording of  $\Delta P(1-3)$  and pump controller output shaft angular position while making a rate change of 5 psi/sec (max) to decrease  $\Delta P(1-3)$  25 to 30 psi below the pump controller setting. The angular rate of the pump controller output shaft shall be at least  $90^\circ$  per second.

7.3 Set PLA = max. Increase PB until  $W_f = 25000$  pph. Adjust sensor for inline regulator until differential across total flow T.V. is 40 psi.

8. PB SERVO CALIBRATION

NOTE: Refer to Build-up Sheet for Dim. K (I-7208-12). If Dim. K is Plus (+) add this amount to the below PB pressures. If Dim. K is negative, subtract this amount to the below Pb pressures.

HAMILTON STANDARD

SPEC. NO. HS 2097

DIVISION OF UNITED AIRCRAFT CORPORATION CODE IDENT NO. 73030

WINDSOR LOCKS, CONNECTICUT, U. S. A.

PAGE 8 OF

- 8.1 Set PLA = 68°, increase  $P_B$  to 30 psia  $\pm$  K, bleeds closed. Adjust  $P_B$  position adjustment until cam follower is in bottom of the detent on the  $P_B$  cam.

NOTE: Bottom of detent is determined by change of motion on dial indicator. Bottom of detent is located at point where indicator reverses direction no more than ( $\pm$ .0001).

- 8.2 Increase  $P_B$  to 215 psia  $\pm$  K. Shim C.B.A. pushrod until cam follower is in bottom of high  $P_B$  detent.

- 8.3 Repeat 8.1 and 8.2 until detents are set.

- 8.4 Set PLA = 68°, bleeds open. Vary  $P_B$  from 5 to 215 psia. Locate low and high  $P_B$  detents. Difference between detents must be 157  $\pm$  2 psi. Adjust CBA pushrod ball follower until this difference is obtained.

- 8.5 Set the bleeds in the closed position and determine that the  $T_{T2}$  cam detents are still located at 30  $\pm$  K and 215  $\pm$  K psia.

- 8.6 Repeat items 8.1 thru 8.6 if required.

9. TEMPERATURE SERVO CALIBRATION

- 9.1 Set  $P_B$  = 30 psia  $\pm$  K, PLA = max.,  $T_{T2}$  = -65°F., bleeds closed. Adjust position spring on the  $T_{T2}$  input lever until the cam calibration follower just starts to come out of the detent ( $\pm$  .0001).

- 9.2 Set  $P_B$  = 30 psia  $\pm$  K, PLA = Max.,  $T_{T2}$  = +950°F., bleeds closed. Adjust rate spring on the flapper until the cam calibration follower just starts to come out of the detent ( $\pm$ .0001).

- 9.3 Repeat items 9.1 and 9.2 until the detents are set.

10. TOTAL FLOW THROTTLE VALVE CALIBRATION

- 10.1 Set  $P_B$  = 50 psia, PLA = 68°,  $T_{T2}$  = +59°F., bleeds closed. Record total flow T.V. displacement and total metered flow. Increase  $P_B$  until disp. changes .100. (T.V. rate is 95.4 PPH/001.).  $W_f$  must change by 9540 PPH  $\pm$  100 PPH. Adjust inline sensor  $\Delta P$  until set.

- 10.2 Bleeds closed, PLA = 0°,  $T_{T2}$  = +59°F.,  $P_B$  = 200 psia. Recirculation flow must be 3000 PPH. Adjust minimum flow stop until this  $W_f$  is obtained.

- 10.3 Set bleeds closed,  $T_{T2}$  = -65°F. Set PLA = max. and read  $W_f$  at 50 and 90  $P_B$ . Then set PLA = 68° and read  $W_f$  at 75 and 150  $P_B$ . Plot these readings. A straight line drawn thru 50 and 90 on the max. line and 75 and 150 on the min. line must intersect at -2.75 psia and -200 pph. The actual intersection will be defined by finite values of  $W_f$  and  $P_B$  ( $W_f$  and  $P_B$  error).

**HAMILTON STANDARD**  
**DIVISION OF UNITED AIRCRAFT CORPORATION**  
**WINDSOR LOCKS, CONNECTICUT, U. S. A.**

SPEC. NO. HS 2097  
CODE IDENT NO. 73030  
PAGE 9 OF

- 10.4 Bleeds closed,  $T_{T2} = -65^{\circ}\text{F.}$ ,  $P_B = 30 \text{ psia}$ ,  $PLA = \text{max.}$  Adjust T.V. multiplying lever hinge until Wf error is reduced to  $-200 \text{ pph.}$
- 10.5 If data lines determined in 10.3 do not intersect at  $-2.75 \text{ psia}$  it will be necessary to reshim the T.V. multiplying lever hinge. Approximately .006 shims will change intercept 1 psi. Adding shims will move intercept to left (minus).
- 10.6  $PLA = 68^{\circ}$ ,  $P_B = 100 \text{ psia}$ ,  $T_{T2} = +60^{\circ}\text{F.}$ , bleeds closed. Adjust power lever servo pilot valve position until Wf = 7420 PPH.
- 10.6.1 Set  $PLA = \text{max.}$ ,  $P_B = 100 \text{ psia}$ ,  $T_{T2} = -65^{\circ}\text{F.}$ , bleeds closed. Record Wf. Increase  $T_{T2}$  to  $+300^{\circ}\text{F.}$  and record Wf. Differential Wf between  $-65^{\circ}\text{F.}$  and  $+300^{\circ}\text{F.}$  must be  $6700 \pm 250 \text{ pph.}$  Adjust the  $T_{T2}$  cam bias adjustment until this differential is obtained. Set PL rate adj. to center of its travel before setting  $T_{T2}$  ball follower adj. screw.
- 10.7 Set  $PLA = \text{max.}$ ,  $P_B = 100 \text{ psia}$ ,  $T_{T2} = -65^{\circ}\text{F.}$ , bleeds closed. Adjust the power lever rate adjust (linkage bracket) until Wf = 43000 pph. At this time check stroke of the power lever servo. Stroke must be  $.900 \pm .100$  for full power lever movement.
- 10.8 Recheck 10.6 and 10.7, as slight trimming adjustment may be necessary.
- \* 10.8.1 Range of Remote Trim Adjustment (PL Servo Rate):  
Set  $P_B = 100 \text{ psia}$ ,  $T_{T2} = +59^{\circ}\text{F.}$ ,  $PLA = \text{Max.}$  Turn adjustment clockwise until it bottoms and record total Wf. Turn adjustment ccw until it bottoms and record total Wf. Limits: Adjustment range must be at least  $\pm 1\%$  of Wf as calibrated. Range determined with this check must be recorded on the final data sheet. Note: Do Not repeat this test during final calibration.
- 10.9 Set  $P_B = 100 \text{ psia}$ ,  $T_{T2} = +59^{\circ}\text{F.}$ , bleeds closed. At these conditions increase PLA until Wf is 13300 pph. Adjust power lever stop to contact piston at this flow.
- 10.10 Bleeds closed,  $T_{T2} = -65^{\circ}\text{F.}$ , Repeat 10.3. Adjust T.V. multiplying lever hinge until the intercept occurs at  $-2.75 \text{ psia}$  and  $+5,900 \text{ pph.}$
- 10.11 Set  $P_B = 23 \text{ psia}$ ,  $PLA = \text{Max.}$ ,  $T_{T2} = +750^{\circ}\text{F.}$ , bleeds closed. Wf must be 12075-12700 pph. Trim to obtain this Wf by a P.L. servo position adjustment.
11. POWER LEVER TORQUE
- 11.1 Maximum Power Lever Torque throughout the operating range shall be no greater than 20 in.-lbs.

HAMILTON STANDARD

SPEC. NO. HS 2097

DIVISION OF UNITED AIRCRAFT CORPORATION CODE IDENT NO., 73030

WINDSOR LOCKS, CONNECTICUT, U. S. A.

PAGE 10 OF

13. PEAK THROTTLE VALVE RATE

13.1 Set PLA = Max.,  $P_B = 50$  psia,  $T_{T2} = +59^\circ\text{F.}$ , bleeds closed. Record  $W_f$  in Zone I. Increase  $P_B$  to 150 psia and record  $W_f$  in Zone I. Difference in  $W_f$  between 50 and 150  $P_B$  must be 25000-26000 pph. Adjust peak valve sensor until this difference is obtained.

13.2 Plot peak line with bleeds closed. Intercept with fuel flow axis, at  $P_B = 0$  psia, should not be off more than 300 pph in either direction. If intercept is off more than  $\pm 300$  pph, reshim 3-D cam to correct error ( $W_f \text{ error}/28 = \text{shims}$ ).

14. FINAL CALIBRATION

NOTE: \*1. A body pressure of  $50 \pm 20$  psig shall be maintained throughout final calibration.

\*2. No adjustments or changes of parts shall be permitted during the final calibration.

\*3. Prior to final calibration all external screws which affect calibration settings shall be lockwired.

14.1 Max. Ratio Calibration - Bleed Closed

\* 14.1.1 Set PLA = Max.,  $T_{T2} = +59^\circ\text{F.}$ , bleeds closed. Record total metered  $W_f$ , T.V.  $\Delta P$ , and P.C.  $\Delta P$  at the following  $P_B$  pressures (Note: Approach  $P_B$  pressures in increasing direction)  $P_B = 15, 20, 40, 60, 80, 100, 120, 140, 180, 140, 80, 40, 20$  and 15 psia. See Appendix A-1 for limits. Hysteresis must be within limits defined in Appendix A-1. Record return to Pump Inlet Flow at 20 and 180 psia. Do Not overshoot when setting  $P_B$  pressures.

## HAMILTON STANDARD

SPEC. NO. HS 2097

DIVISION OF UNITED AIRCRAFT CORPORATION

CODE IDENT NO. 73030

WINDSOR LOCKS, CONNECTICUT, U. S. A.

PAGE 11 OF

- \* 14.1.2 Set PLA = Max., bleeds closed,  $P_B = 100$  psia,  $T_{T2}$  less than  $20^\circ\text{F}$ . Increase  $T_{T2}$  to  $+59^\circ\text{F}$ ., allow to stabilize for at least one minute and record fuel flow. Increase  $T_{T2}$  to  $+150^\circ\text{F}$ ., hold for at least one minute, then reduce it to  $+59^\circ\text{F}$ .. Allow one or more minutes to stabilize and record fuel flow. Limits shall be as defined in Appendix A-1 for  $P_B = 100$  psia.

#### 14.2 Min. Ratio Calibration - Bleeds Closed

- \* 14.2.1 Set PLA =  $67^\circ$ ,  $T_{T2} = +59^\circ\text{F}$ ., bleeds closed. Record total metered Wf, T.V.  $\Delta P$ , and P.C.  $\Delta P$  at the following PB pressures: 15, 20, 40, 100, 180, 100, 40, and 15 psia. See Appendix B-1 for limits. Hysteresis must be within the limits defined in Appendix B-1. (Note: Do Not overshoot when setting PB pressures.)

#### 14.3 Power Lever Sequences and Transient

- \* 14.3.1 Set PLA = Max.,  $T_{T2} = +59^\circ\text{F}$ .,  $P_B = 18$  psia, bleeds closed. Decrease PLA to  $0^\circ$  then slowly increase PLA. At  $66^\circ - 67^\circ$ , the recirculation valve must close at or after the time at which the Zone I manifold S.O.V. opens. Increase PLA to Max. Slowly decrease PLA and record PLA at which S.O.V. closes. PLA must be within  $65^\circ - 67^\circ$  when S.O.V. closes. Recirculation valve must open at or before the time at which the S.O.V. closes.
- \* 14.3.2 Set arming signal at 0 to 50 psig, PLA =  $0^\circ$ ,  $T_{T2} = +59^\circ\text{F}$ .,  $P_B = 20$  psia. Now advance the power lever to approximately  $75^\circ$ . Slowly increase arming signal pressure until the S.O.V. opens and record this pressure. Limits: The pressure must be between 30 and 110 psig above body pressure.
- \* 14.3.3 Set  $P_B = 100$  psia and  $T_{T2} = +59^\circ\text{F}$ .. Change PLA from  $68^\circ$  to max. within .8 to 1.2 seconds. The control fuel flow shall increase at a rate not to exceed 300 Wf/ $P_B$  ratios per second and complete 90% of the transient in 2 seconds or less.
- \* 14.3.4 Set  $P_B = 100$  psia and  $T_{T2} = +59^\circ\text{F}$ .. Change PLA from Max. to  $68^\circ$  within .8 to 1.2 seconds. The control fuel flow shall complete 90% of the transient in 2 seconds or less.
- \* 14.3.5 Set  $P_B = 100$  psia and  $T_{T2} = +59^\circ\text{F}$ .. Bleeds closed. Maximum Power Lever Torque throughout the operating range shall be no greater than 20 in-lbs.

#### 14.4 Temperature ( $T_{T2}$ ) Sensing Calibration - (See Appendix C-1 for Limits)

Note: All temperatures ( $T_{T2}$ ) to be actual bulb temperature for final calibration.

HAMILTON STANDARD

SPEC. NO. HS 2097

DIVISION OF UNITED AIRCRAFT CORPORATION

CODE IDENT NO. 73030

WINDSOR LOCKS, CONNECTICUT, U. S. A.

PAGE 12 OF

\* 14.4.1 Set PLA = max,  $T_{T2} = -65^{\circ}\text{F}$ , bleeds closed. Record total metered WF at the PB pressures noted in Appendix C-1 (Note: Approach PB pressures in increasing direction.)

\* 14.4.2 Repeat item 14.4.1 at temperatures ( $T_{T2}$ ) of  $200^{\circ}\text{F}$ .

14.4.3 Repeat item 14.4.1 with bleeds open at  $T_{T2}$  of  $200^{\circ}\text{F}$ ,  $300^{\circ}\text{F}$ ,  $500^{\circ}\text{F}$  and  $750^{\circ}\text{F}$ . Include hysteresis on  $750^{\circ}\text{F}$  line.

\* 14.4.4 The force required to open and close CBA pushrod shall not exceed 20 lbs., when body pressure is at 50 psig.

14.6 Recirculation Calibration

\* 14.6.1 Set PLA =  $0^{\circ}$ , PB = 100 psia,  $T_{T2} = +59^{\circ}\text{F}$ , bleeds closed. Metered WF must be 2850 - 3150 pph. Record control inlet pressure and control body pressure. Control inlet pressure must be within 80 - 200 psi above control body pressure.

14.7 Repeatability Checks

\* 14.7.1 Check repeatability in accordance with and in sequence indicated in Appendix E-1.

\* 14.7.2 Re-run per paragraph 14.7.1 two additional times. Re-run paragraph 14.7.1 a total of 9 additional times only if requested by HS Engineering. Cycle bleeds open to bleeds closed twice before starting each re-run.

14.8 Leak Check

\* 14.8.1 With all instrumentation removed from control, set the PLA at Max, set PB at 150 psia,  $T_{T2}$  at  $+59^{\circ}\text{F}$ , bleeds closed.

\* 14.8.1.1 Check external leakage. No leakage allowed except for pump controller drain and PB drain.

The term "no leakage" shall be defined as the permissible visual appearance of fluid on the external surface of a control which does not become progressively greater during a 5 minute period to such a degree that fluid runs off the surface of the control or forms droplets.

\* 14.8.1.2 Check overboard drain leakage. Allowable leakage shall be no more than 10 dpm from the PB drain and 30 dpm from the pump controller drain.

\* 14.8.1.3 Remove recirculation line from the control and check recirculation valve leakage. Leakage from the recirculation port must not exceed 20 cc/min.

\* 14.8.1.4 Pressurize overboard drain port on pump controller to 10 psig. The external leakage shall not be greater than 8 dpm per seal.



HAMILTON STANDARD SPEC. NO.  
DIVISION OF UNITED AIRCRAFT CORPORATION CODE IDENT  
WINDSOR LOCKS, CONNECTICUT, U. S. A. PAGE 13

\* 14.8.2 Shut-Off Valve Leakage

Note: Allow ten minutes for lines to drain before taking leakage reading.

- \* 14.8.2.1 Set PLA = 0°, TT<sub>2</sub> = +59°F, PB = 15 psia, bleeds closed, with main and boost pumps operating. Remove Zone I outlet line. Leakage in Zone I must not exceed 10 dpm.  
\* Shut down main pump.

- \* 14.8.2.2 Set PLA=0°, TT<sub>2</sub> = +59°F, PB = 15 PSIA. Maintain boost pressure at 50 psig. Remove Zone I outlet line. Leakage must not exceed 10 dpm.

14.9 Power Lever Cam Calibration Check

- \* 14.9.1 Set PB of 100 psia, TT<sub>2</sub> = +59°F. Set, in sequence, power lever angles of 68°, 80°, 90°, 100°, 110°, 120°, 100°, 80°, 68°. Record total Wf at each point.

- \* 14.10 The "K" dimension used in setting up the PB system position must be recorded on the final data log sheets.

14.11 Hot Test Requirements

- 14.11.1 The following items shall be run three times in the following sequence. First with fuel temperature at 100 ± 5°F, then with fuel temperature at 325 - 350°F, then with fuel temperature at 100 ± 5°F. All runs are to be made at room temperature ambient conditions.

- \* 14.11.1.1 Set PLA at Max, TT<sub>2</sub> at +59°F, bleeds closed. Record total flow at the following CDP pressures: 20, 60, 100, 120 psia. Note: Set CDP in the increasing pressure direction. See Appendix A-1 for limits.

- \* 14.11.1.2 Set PLA at max, TT<sub>2</sub> at +750°F, bleeds open. Record total flow at the following CDP pressures: 20, 30, 50, 100 hysteresis 50, 30 and 20 psia. See Appendix C-1 for limits.

- 14.11.2 Repeat paragraph 14.3.2 to be sure speed signal valve is still operative.

15. PRESERVATION AND STORAGE

- 15.1 At conclusion of bench calibration, drain the calibration fluid from the control and prepare the control for shipment in accordance with H.S. Specification 380.

NOTE: Controls which have been insulated prior to running final bench calibration data must be heated in a ventilated oven at 250° ± 10°F. for a period of 1 to 1½ hours after draining calibrating fluid from the control.

HAMILTON STANDARD

SPEC. NO. HS 2097

DIVISION OF UNITED AIRCRAFT CORPORATION

CODE IDENT NO. 73030

WINDSOR LOCKS, CONNECTICUT, U. S. A.

PAGE 11 OF

\* 15.2

The "dry weight of the control shall be recorded on the installation inspection sheet.

HAMILTON STANDARD SPEC. NO. HS 2097  
DIVISION OF UNITED AIRCRAFT CORPORATION CODE IDENT NO. 73030  
WINDSOR LOCKS, CONNECTICUT, U. S. A. PAGE 15 OF

APPENDIX A-1

<u>PR</u>	<u>Conditions</u>	<u>Total Wf Limits</u>
15	TT2 = +59°F. Bleeds Closed PLA = Max.	5970 - 6600
20		7880 - 8720
40		15540 - 17180
60		23250 - 25700
80		31050 - 34300
100		38000 - 42800
120		45900 - 50700
140		53500 - 59000

APPENDIX B-1

<u>PR</u>	<u>Conditions</u>	<u>Total Wf Limits</u>
15	TT2 = +59°F.	2850 - 3150
20		2850 - 3150
40		5050 - 5600
100	Bleeds closed PLA = 68°	12600 - 14000
180		22700 - 25150

APPENDIX C-1

Temperature Sensing Calibration

TT2 = -65°F. B.C.

TT2 = +300°F. B.O.

<u>PR</u>	<u>Total Wf Limits</u>	<u>PR</u>	<u>Total Wf Limits</u>
15	7460 - 8250	15	7380 - 8160
20	9920 - 10960	20	9850 - 10900
60	28600 - 31650	60	28600 - 31600
100	47000 - 52000	100	44700 - 49500
120	56300 - 62200	120	53200 - 58850

HAMILTON STANDARD

SPEC. NO. HS 2097

DIVISION OF UNITED AIRCRAFT CORPORATION

CODE IDENT NO. 73030

WINDSOR LOCKS, CONNECTICUT, U. S. A.

PAGE 16 OF

APPENDIX C-1

(Continued)

T<sub>T2</sub> = +200°F. B.C.

<u>P<sub>R</sub></u>	<u>Total Wf Limits</u>
15	5900 - 6530
20	7970 - 8810
60	23940 - 26470
100	38900 - 43000
150	56600 - 62600

T<sub>T2</sub> = +500°F. B.O.

<u>P<sub>R</sub></u>	<u>Total Wf Limits</u>
15	7820 - 8650
20	10380 - 11180
60	27800 - 29850
100	44380 - 49050
120	53100 - 58680

T<sub>T2</sub> = +750°F. B.O.

<u>P<sub>R</sub></u>	<u>Total Wf Limits</u>
15	6910 - 7650
20	8960 - 9910
30	13730 - 14440
50	22330 - 23960
100	43350 - 47900
120	51700 - 57200

T<sub>T2</sub> = +200°F. B.O.

<u>P<sub>R</sub></u>	<u>Total Wf Limits</u>
15	The observed flow readings shall be 17 1/2 to 19 1/2% higher than the observed flow readings for T <sub>T2</sub> = +200°F. B.C.
20	
60	
100	
100	

NOTE: Hysteresis Wf must be within specified limits.

APPENDIX D-1

<u>Wf</u>	<u>Zone I Injection Manifold</u> (psi)
3000	90 - 110
6000	110 - 165
10000	195 - 225
20000	300 - 345
30000	390 - 440
40000	460 - 520

HAMILTON STANDARD SPEC. NO. HS 2097  
 DIVISION OF UNITED AIRCRAFT CORPORATION CODE IDENT NO. 73030  
 WINDSOR LOCKS, CONNECTICUT, U. S. A. PAGE 17 OF

APPENDIX E-1

	(PSIA) <u>P<sub>R</sub></u>	<u>Conditions</u>	Total PPH <u>Wf Limits</u>
1)	20 120	(T <sub>T2</sub> = +59°F. B.C.) PLA = Max.	7880 - 8720 45900 - 50700
2)	20 120	(T <sub>T2</sub> = +750°F. B.O.) PLA = Max.	8960 - 9910 51700 - 57200

HAMILTON STANDARD  
DIVISION OF UNITED AIRCRAFT CORPORATION  
WINDSOR LOCKS, CONNECTICUT

H.S. 2007  
Amend. /  
Page 1 of 10  
E.C. 72022  
Date: 9-22-62

H.S. 2007 Afterburner Control JFC 51 Acceptance of

Amendment \_\_\_\_\_/\_\_\_\_\_

1. Change paragraph 1.2.3 to read:

"1.2.3 Constant temperature baths capable of maintaining temperature of  $-65^{\circ}$ ,  $+59^{\circ}$ , and  $+200^{\circ}$  within  $\pm 5^{\circ}\text{F.}$ "

2. Change paragraph 1.2.3.1 to read:

"1.2.3.1 Temperature equipment to maintain temperature from  $+200^{\circ}\text{F.}$  to  $+950^{\circ}\text{F.}$  during hot testing. Temperatures to be accurate within  $\pm 10^{\circ}\text{F.}$ "

3. Change paragraph 1.2.11 to read:

"1.2.11 An Orifice sized to flow  $170 \pm 10$  PPH with a  $\Delta P$  of 75 PSI across it."

4. Add paragraph 1.2.13 to read as follows:

"1.2.13 Power Lever Protractor-  $5^{\circ}$  to  $130^{\circ}$  graduated in  $1^{\circ}$  increments."

5. Change old paragraph 1.2.13 to read:

"1.2.14 "

6. Change paragraph 1.2.13.1 to read:

"1.2.14.1 "

7. Change paragraph 1.3.3 to read:

"1.3.3 The following readings shall be recorded when noted:

1. Arming signal. . . . . PSIG
2. Pressure in recirculation line. . . . . PR"

8. Change paragraph 2.2 to read:

"2.2 Retest Requirements: If settings listed under "Reset" are re-adjusted or if assemblies or parts listed under "Replace" are replaced or removed for repair, the settings listed under corresponding "Retest" must be retested and settings not yet tested must be completed."

HAMILTON STANDARD  
DIVISION OF UNITED AIRCRAFT CORPORATION  
WINDSOR LOCKS, CONNECTICUT

H.S. 2097  
Amend. /  
Page 2 of 10  
E.C. 72032  
Date: 9-22-62

H.S. 2097 Afterburner Control JFC 51 Acceptance 6F

Amendment /

Reset

PR Servo (8.0)  
Temperature Servo (9.0)  
Total Flow T.V. (10.0)

Power Lever (6.1)

Retest

12.1.1, 12.2.1, 12.4.1, 12.4.2  
12.1.1, 12.4.1, 12.4.2  
12.1.1, 12.2.1, 12.4.1, 12.4.2

6.2, 6.3

Replace

Servo Housing  
Temperature Servo  
Transfer Housing  
Zone I Outlet Housing  
Zone II Outlet Housing  
Pump Controller

8.0, 12.1.1, 12.2.1, 12.4.1, 12.4.2  
9.0, 12.1.1, 12.4.1, 12.4.2  
12.0, 12.5.1, 12.5.2  
12.8.2.1, 12.8.2.2  
12.8.1.3  
7.1, 7.2.1, 7.2.2"

9. Change paragraph 3.2 to read:

"3.2 Install 80 PSI differential gage across the total flow throttle valve, and install 200 PSI differential gage across the total flow T.V. and inline regulator."

10. Add paragraph 3.6 to read as follows:

"3.6 The Orifice specified in paragraph 1.2.11 shall be installed in a line connected between the tap on the recirculation valve cover and the external connection mounted on the Zone I cover."

11. Add paragraph 6.3 to read as follows:

"6.3 Check to be sure that the Power Lever stops on the external stop plate. If it doesn't stop externally (at 125° end of rotation) adjust the TOPV one turn CCW, then readjust the TOPV per paragraph 6.2 and recheck. Repeat if necessary.

If the Power Lever does not stop externally at the -5° position, follow the above procedure except that the TOPV will be turned CW."

12. Change paragraph 10.1 to read:





HAMILTON STANDARD  
DIVISION OF UNITED AIRCRAFT CORPORATION  
WINDSOR LOCKS, CONNECTICUT

H.S. 2097  
Amend. 1  
Page 11 of 10  
E.C. 72932  
Date: 9-22-62

H.S. 2097 Afterburner Control JTC 51 Acceptance OK

Amendment 1

20. Change paragraph 14.1 to read:

"12.1"

22. Change paragraph 14.1.1 to read:

"12.1.1 Set FIA = Max.,  $T_{12}$  = +59°F., bleeds closed. Record total metered Wf, T.V.  $\Delta P$ , and P.C.  $\Delta P$  at the following  $P_B$  pressures (Note: Approach  $P_B$  pressures in increasing direction)  $P_B$  = 15, 20, 40, 60, 80, 100, 120, 140, 160, 120, 80, 40, 20 and 15 psia. See Appendix A-1 for limits. Hysteresis must be within limits defined in Appendix A-1. Record return to Pump Inlet Flow at 20 and 160 psia. Do not overshoot when setting  $P_B$  pressures.

23. Change paragraph 14.1.2 to read:

"12.1.2"

24. Change paragraph 14.2 to read:

"12.2"

26. Change paragraph 14.2.1 to read:

"12.2.1 Set FIA = 68°,  $T_{12}$  = +59°F., bleeds closed. Record total metered Wf, T.V.  $\Delta P$ , and P.C.  $\Delta P$  at the following  $P_B$  pressures: 15, 20, 40, 100, 160, 100, 40, and 15 psia. See Appendix B-1 for limits. Hysteresis must be within the limits defined in Appendix B-1. (Note: Do Not overshoot when setting  $P_B$  pressures.)"

27. Change paragraph 14.3 to read:

"12.3"

28. Change paragraph 14.3.1 to read:

U.S. 2077  
 Amend. 1.1  
 Page 5 of 5  
 E.O. 12812  
 Date 12-1-77

# 2025 Interturner Control System Interference of Amendment

1. Set FIA - Max.,  $T_{12} = +59^{\circ}\text{F}$ ,  $T_{13} = 18\text{ psia}$ , bleeds closed. Decrease FIA to 0" then slowly increase FIA. At  $66^{\circ} - 67^{\circ}$  the recirculation valve must close at or after the time at which the Zone I manifold S.O.V. opens. Increase FIA to Max. Slowly decrease FIA and record FIA at which S.O.V. closes. FIA must be within  $65^{\circ} - 67^{\circ}$  when S.O.V. closes. Recirculation valve must open at or before the time at which the S.O.V. closes. At  $67^{\circ}$  insert the indexing pin thru the slot in the indexing ring and into the stop plate hole."

20. Change paragraph 14.3.2 to read:  
 "12.3.2"

21. Change paragraph 14.3.3 to read:  
 "12.3.3"

22. Change paragraph 14.3.4 to read:  
 "12.3.4"

23. Change paragraph 14.3.5 to read:  
 "12.3.5"

24. Change paragraph 14.4 to read:  
 "12.4"

25. Change paragraph 14.4.1 to read:  
 "12.4.1"

26. Change paragraph 14.4.2 to read:  
 "12.4.2"

27. Change paragraph 14.4.3 to read:  
 "12.4.3"

28. Change paragraph 14.4.4 to read:  
 "12.4.4"

BRANTON STATION  
DIVISION OF UNITED AIRCRAFT CORPORATION  
WINDSOR LOCKS, CONNECTICUT

H.S. 2097  
Amend. 1  
Page 6 of 10  
E.C. 72932  
Date: 9-22-62

H.S. 2097 Afterburner Control JFC 51 Acceptance of

Amendment 1

39. Change paragraph 14.6 to read:  
"12.6"
40. Change paragraph 14.6.1 to read:  
"12.6.1"
41. Change paragraph 14.7. to read:  
"12.7."
42. Change paragraph 14.7.1 to read:  
"12.7.1"
43. Change paragraph 14.7.2 to read:  
"12.7.2"
44. Change paragraph 14.8 to read:  
"12.8"
45. Change paragraph 14.8.1 to read:  
"12.8.1"
46. Change paragraph 14.8.1.1 to read:  
"12.8.1.1"
47. Change paragraph 14.8.1.2 to read:  
"12.8.1.2"
48. Change paragraph 14.8.1.3 to read:  
"12.8.1.3"
49. Change paragraph 14.8.1.4 to read:  
"12.8.1.4"

HAMILTON STANDARD  
DIVISION OF UNITED AIRCRAFT CORPORATION  
WINDSOR LOCKS, CONNECTICUT

H.S. 2097  
Amend. 1  
Page 7 of 10  
E.C. 72932  
Date: 9-22-62

H.S. 2097 Afterburner Control JFC 51 Acceptance of

Amendment 1

50. Change paragraph 14.8.2 to read:  
" 12.8.2 "
51. Change paragraph 14.8.2.1 to read:  
" 12.8.2.1 "
52. Change paragraph 14.8.2.2 to read:  
" 12.8.2.2 "
53. Change paragraph 14.9 to read :  
" 12.9 "
54. Change paragraph 14.9.1 to read:  
" 12.9.1 "
55. Change paragraph 14.10 to read:  
" 12.10 "
56. Change paragraph 14.11 to read:  
" 12.11 "
57. Change paragraph 14.11.1 to read:  
" 12.11.1 "
58. Change paragraph 14.11.1.1 to read:  
" 12.11.1.1 "

HAMILTON STANDARD  
DIVISION OF UNITED AIRCRAFT CORPORATION  
WINDSOR LOCKS, CONNECTICUT

H.S. 2097  
Amend. 1  
Page 3 of 10  
B.C. 72932  
Date: 9-22-62

H.S. 2097 Afterburner Control JTC 51 Acceptance of

Amendment 1

60. Change paragraph 14.11.1.2 to read:

14.11.1.2 Set PLA at max,  $T_{T2}$  at  $+750^{\circ}\text{F}$ , bleeds open. Record total flow at the following CDP pressures: 20, 30, 50, 100, 120 hysteresis 100, 50, 30 and 20 psia. See Appendix C-1 for limits."

62. Change paragraph 14.11.2 to read:

14.11.2 Repeat paragraph 12.3.2 to be sure speed signal valve is still operative."

63. Change paragraph 15 to read:

" 13 "

64. Change paragraph 15.1 to read:

"13.1"

65. Change paragraph 15.2 to read:

" 13.2 "

✓ 66. Change Appendix A-1. to read:

<u>P<sub>3</sub></u>	<u>Conditions</u>	<u>Total WC Limits</u>
15	$T_{T2} = +59^{\circ}\text{F}$	5970 - 6600
20	Bleeds	7880 - 8720
40	Closed	15510 - 17180
60	FLA = Max.	23300 - 25800
80		31050 - 31300
100		38600 - 42800
120		45900 - 50700
140		53500 - 59000
160		57000 - 63000

HAMILTON STANDARD  
DIVISION OF UNITED AIRCRAFT CORPORATION  
WINDSOR LOCKS, CONNECTICUT

H.S. 2097  
Amend. /  
Page 9 of 10  
B.C. 72932  
Date: 9-22-62

H.S. 2097 Afterburner Control JFC 51 Acceptance of

Amendment /

67. Change Appendix B-1 to read:

<u>P<sub>B</sub></u>	<u>Conditions</u>	<u>Total Wf Limits</u>
15	T <sub>T2</sub> = +59°F	2850 - 3150
20		2850 - 3150
40		5050 - 5600
100	Bleeds closed	12600 - 14000
160	PLA = 68°	20200 - 22400

68. Change Appendix C-1 to read:

Temperature Sensing Calibration

T<sub>T2</sub> = - 65°F., B. C.

<u>P<sub>B</sub></u>	<u>Total Wf Limits</u>
15	7160 - 8250
20	9920 - 10960
60	28600 - 31650
100	47000 - 52000
120	56300 - 62200
160	57000 - 63000

T<sub>T2</sub> = + 300°F., B. O.

<u>P<sub>B</sub></u>	<u>Total Wf Limits</u>
15	7380 - 8160
20	9850 - 10900
60	28600 - 31600
100	44700 - 49500
120	53300 - 59000

T<sub>T2</sub> = +200°F., B. C.

<u>P<sub>B</sub></u>	<u>Total Wf Limits</u>
15	5900 - 6530
20	7950 - 8800
60	23940 - 26470
100	39000 - 43200
120	45900 - 50800
150	56600 - 62600

T<sub>T2</sub> = +500°F., B.O.

<u>P<sub>B</sub></u>	<u>Total Wf Limits</u>
15	7800 - 8700
20	10300 - 11500
60	27400 - 30400
100	41400 - 49200
120	53000 - 58700

HAMILTON STANDARD  
DIVISION OF UNITED AIRCRAFT CORPORATION  
WINDSOR LOCKS, CONNECTICUT

H.S. 2097  
Amend. /  
Page 10 of 10  
E.C. 72932  
Date: 9-22-62

H.S. 2097 Afterburner Control JFC 51 Acceptance of  
Amendment /

$T_{T2} = + 750^{\circ} \text{F. B.O.}$

$T_{T2} = + 200^{\circ} \text{F. B. O.}$

<u>P<sub>B</sub></u>	<u>Total Wf Limits</u>	<u>P<sub>B</sub></u>	<u>Total Wf Limits</u>
15	6900 - 7660	15	7020 - 7780
20	8960 - 9920	20	9440 - 10460
30	13720 - 14440		
50	22300 - 24000	60	28500 - 31500
100	43300 - 47900	100	45900 - 50100
120	51700 - 57200	120	54300 - 60100

NOTE: Hysteresis Wf must be within specified limits.



HAMILTON STANDARD  
DIVISION OF UNITED AIRCRAFT CORPORATION  
WINDSOR LOCKS, CONNECTICUT

H.S. 2097  
Amend. 2  
Page 1 of 1  
E.C. AZ72932-1  
Date: 10-9-62

H.S. H. S. 2097 AFTERBURNER CONTROL JFC51

Amendment 2

1. Change paragraph 8.4 to read:

8.4 "Set PLA = 68°, bleeds open. Vary PB from 5 to 215 psia. Locate low and high PB detents. Difference between detents must be  $157 \pm 2$  psi. Adjust GBA pushrod ball follower until this difference is obtained. The low detent must occur 5 to 7 psi below the bleeds closed detent position.

2. Change paragraph 12.9.1 to read:

\*12.9.1 Set PB of 100 psia, TT2 = +59°F. Set, in sequence, power lever angles of 68°, 80°, 90°, 100°, 110°, 112°, 115°, 123°, 125°, 100°, 80°, 68°. Record total Wf at each point.

Limits: Difference between Wft readings at 112, 115, & 123 shall be no greater than 600 PPH.



HAMILTON STANDARD  
DIVISION OF UNITED AIRCRAFT CORPORATION  
WINDSOR LOCKS, CONNECTICUT

H.S. 2097

Amend. 3

Page 1 of 1

E.C. 73652

Date: 10-19-62

H.S. 2097 "AFTERBURNER CONTROL JFC51 ACCEPTANCE OF"

Amendment 3

1. Add paragraph \*6.1.1 to read:

\*6.1.1 "Sheet test rig off and remove the T.O.P.V. adjustment access cover. Mount a dial indicator (.250 inch stroke minimum) thru this access hole to contact the T.O.P.V. end. Rotate the power lever from 0 to 125°. Dial indicator should show a change in displacement of .166 minimum. At 67° PLA the dial indicator must show a displacement of .030 to .080 from the 0° PLA. Adjust the T.O.P.V. cam until this is obtained. Lock cam in place."

2. Change paragraph 6.2 to read:

\*6.2 Check to be sure that the power lever stops on the external stop plate. If it doesn't stop externally (at 125° end of rotation) adjust the T.O.P.V. cam but still keeping within displacement limits in 6.1.1. Lock cam. No further adjustments are to be made on this cam.

Caution: Torque on adjusting screws to be 15-20 in-lb."

3. Change paragraph 6.3 to read:

6.3 "Set PLA = Max, PB = 15 psia. Decrease PLA to 0°. Apply 150 psig to speed signal valve. Increase PLA to 67°. Adjust the T.O.P.V. until the recirculation valve closes and the Zone I SOV is open."

HAMILTON STANDARD  
DIVISION OF UNITED AIRCRAFT CORPORATION  
WINDSOR LOCKS, CONNECTICUT

H.S. 2097

Amend. 4

Page 1 of 2

E.C. AZ73796

Date: 10-25-67

H.S. 2097 "AFTERBURNER CONTROL JF051 ACCEPTANCE OF"

Amendment 4

1. In paragraph 2.2, add section no. "13.0" to each line under the "retest" heading for both the reset and replace divisions.
2. Add paragraph 9.4 to read:  
" \*9.4 Record TT2 (°F) versus Tt2 displacement at Tt2 of -65°F, +200°F, +300°F, +500°F, and +750°F. Displacement must be within  $\pm .015$  of the nominal curve in HS1434, Appendix B."
3. Change paragraph \*12.8.1.3 to read:  
" \*12.8.1.3 Remove recirculation line from the control and ~~check~~ recirculation valve leakage. Leakage from the recirculation port must not exceed 40 cc/min."
4. Change paragraph \*12.8.2.1 to read:  
" \*12.8.2.1 Set PLA = 0°, Tt2 = +59°F, PB = 15 psia, bleeds closed with main and boost pumps operating. Remove Zone I outlet line. Leakage in Zone I must not exceed 30 dph. Shut down main pump."
5. Change paragraph \*12.8.2.2 to read:  
" \*12.8.2.2 Set PLA = 0°, Tt2 = +59°F, PB = 15 psia. Maintain boost pressure at 50 psig. Remove Zone I outlet line. Leakage must not exceed 30 dpm."
6. Change paragraph 12.11.1 to read:  
" 12.11.1 The following items shall be run three times in the following sequence:  
a) Fuel temperature at  $100 \pm 5^\circ\text{F}$ .  
b) Fuel temperature at 325-350°F.  
\*c) Fuel temperature at  $100 \pm 5^\circ\text{F}$   
\*d) Fuel temperature at 325-350°F  
\*e) Fuel temperature at  $100 \pm 5^\circ\text{F}$   
All runs are to be made at room temperature ambient conditions."
7. Change paragraph 13 to read:  
" \*13. FINAL LEAKAGE CHECK "

HAMILTON STANDARD  
DIVISION OF UNITED AIRCRAFT CORPORATION  
WINDSOR LOCKS, CONNECTICUT

H.S. 2097  
Amend. 4  
Page 2 of 2  
E.O. A273796  
Date: 10-25-62

H.S. 2097 "AFTERBURNER CONTROL JFC51 ACCEPTANCE OF"

Amendment 4

8. Change paragraph 13.1 to read:

"\*13.1 The following sequence is to be used to make a final leakage check after running hot with all surfaces dry before starting this check. Hold at each condition for 1 minute before checking for leakage. Check leakage for 5 minutes at each setting. No external leakage is allowed. The term "no leakage" is defined in paragraph \*12.8.1.1."

9. Add paragraph 13.1.1 to read:

"\*13.1.1 Set PLA = 0°, CDP = 15, Tt2 = +59°F, B.C., and PB = 50 psia."

10. Add paragraph 13.1.2 to read:

"\*13.1.2 Increase PLA = 70°."

11. Add paragraph 13.1.3 to read:

"\*13.1.3 Increase PLA = max, increase CDP = 120 psia."

12. Add paragraph 13.1.4 to read:

"\*13.1.4 Decrease CDP = 40 psia, B.C., increase Tt2 = +200°F."

13. Add paragraph 13.1.5 to read:

"\*13.1.5 Decrease PLA = 0°, B.C., CDP = 40, decrease Tt2 = +59°F."

14. Change old paragraph number 13 to read "14."

15. Change old paragraph number 13.1 to read "14.1."

16. Change old paragraph number \*13.2 to read "\*14.2."

HAMILTON STANDARD  
DIVISION OF UNITED AIRCRAFT CORPORATION  
WINDSOR LOCKS, CONNECTICUT

H.S. 2097  
Amend. 3  
Page 1 of 2  
E.O. 73752  
Date: 11-3-62

H.S. 2097 "AFTERBURNER CONTROL JFC51 ACCEPTANCE OF"

Amendment 5

Amend HS2097 as follows:

1. Change paragraph 1.3.1 to read:

1.3.1 "The following abbreviations are used in this specification:

- |   |                             |
|---|-----------------------------|
| 1. Total Metered Fuel Flow                | -----Wft                    |
| 2. Absolute Burner Pressure               | -----PB                     |
| 3. Inlet Bulb Temperature (*F)            | -----Tt2                    |
| 4. Power Lever Angle                      | -----PLA                    |
| 5. Compressor Bleed Position              | -----CBA                    |
| 6. Throttle Valve Differential (PSIG)     | -----T.V. ΔP                |
| 7. Pump Controller Differential (PSIG)    | -----P.C. ΔP                |
| 8. Control Inlet Pressure (PSIG)          | -----Pin                    |
| 9. Control Outlet Pressure (PSIG)         | -----Pout                   |
| 10. Control Body Pressure (PSIG)          | -----PcB                    |
| 11. Pressure in Recirculation Line (PSIG) | -----Pr                     |
| 12. Clockwise                             | -----CW                     |
| 13. Counterclockwise                      | -----CCW                    |
| 14. Military PLA                          | -----Max (Wide Open Thrott) |
| 15. Test Fluid Temperature (*F)           | -----Ttf"                   |

2. Delete paragraphs 1.3.2, 1.3.3, 1.3.4. Renumber paragraph 1.3.5 as 1.3.2.

3. Change paragraph 12.1.1 as follows:

12.1.1 "In second sentence add to values to be recorded 'Pin, Pout'.  
Add as sixth sentence, 'Record Ttf and PoB at initial Pb = 15  
setting and at final Pb = 15 setting'."

4. Change paragraph 12.2.1 as follows:

12.2.1 "In second sentence add to values to be recorded 'Pout'. Add,  
as last sentence, 'Record Pin, PoB and Ttf at initial Pb = 15  
setting and at final Pb = 15 setting.'"

5. Change paragraph 12.4.1 as follows:

12.4.1 "In second sentence add to values to be recorded 'Pout,' Add, as  
last sentence, 'Record Pin, Pout and Ttf at initial Pb = 15 setting  
and at final Pb = 160 setting.'"

6. Change paragraph 12.4.2 as follows:

12.4.2. "Add, as last sentence, 'Record Pin, Pout & Ttf at initial Pb = 15  
setting and at final Pb = 150 setting.'"

HAMILTON STANDARD  
DIVISION OF UNITED AIRCRAFT CORPORATION  
WINDSOR LOCKS, CONNECTICUT

H.S. 2097  
Amend. 3  
Page 2 of 2  
E.O. 13752  
Date: 11-3-67

H.S. 2097 "AFTERBURNER CONTROL JFC51 ACCEPTANCE OF"

Amendment 5

7. Change paragraph 12.4.3 as follows: "Add, as last sentence, 'For each setting of Tt2 record Pin, PcB and TtF at initial Pb = 15 setting and at final Pb = 120 setting.'"
8. Change paragraph 12.7.1 as follows:  
12.7.1 "Add, as last sentence, 'Record Wft, Pin, Pout, Ttf and PcB for each Pb setting.'"
9. Change paragraph 12.9.1 as follows:  
12.9.1 "In third sentence add to values to be recorded 'Pout'. Add, as last sentence, 'Record Pin, Ttf and PcB at initial PLA = 68° setting and at final PLA = 68° setting.'"
10. Change paragraph 12.11.1.1 as follows:  
12.11.1.1 "In second sentence add to values to be recorded 'Pout'. Add, as last sentence 'Record Pin, Ttf and PcB at initial CDP = 20 setting and at final CDP = 120 setting.'"
11. Change paragraph 12.11.1.2 as follows:  
12.11.1.2 "In second sentence add to values to be recorded 'Pout'. Add, as last sentence, 'Record Pin, Ttf and PcB at initial CDP = 20 setting and at final CDP = 20 setting.'"

**Page Denied**

## HAMILTON STANDARD

SPEC. NO. HS 1595 B

DIVISION OF UNITED AIRCRAFT CORPORATION

CODE IDENT NO. 73030

WINDSOR LOCKS, CONNECTICUT, U. S. A.

PAGE 2 OF

1.0 GENERAL INFORMATION1.1 Scope

This specification covers the method for testing the model JFC51 After-burner Fuel Control 576500.

1.2 Equipment Required

- Flow bench with a boost pump capable of supplying 10-70 psig fuel pressure to the main pumps in a closed loop system of operation. Main pumps capable of supplying 65000 PPH at 1000 psig pump discharge pressure. Two metered flow meters; Zone 1 and Zone 2. Zone 1 meter must be accurate to 0.5% in the 3000 PPH to 5000 PPH range and the Zone 2 meter must be accurate to 0.5% in the 1500-25000 PPH range. A recirculation line flowmeter accurate to 1.0% in the 350-5000 PPH range. An internal leakage flowmeter accurate to 2.0% in the 350-3000 PPH range. Pump discharge pressure to be controlled as a function of pump controller output thru a system of relief valves in pump discharge line.

1.2.1 Test fluid will be MIL 9073. Maintain control inlet and flow meter inlet at 100° ± 5° F except as specified for hot testing.

1.2.2 Pneumatic pressure source and two gages for simulating engine burner pressure capable of maintaining for a minimum period of 0.5 hour any pressure between 10 and 300 PSIA. One gage 0 to 500 psia accurate to ± 0.25 psia. One gage 0 to 300 psia accurate to ± 0.25 psia over a range of 50 to 300 psia.

1.2.3 Constant temperature baths capable of maintaining temperature of -65°, 0°, +59°, & +150° within ±5°F.

1.2.3.1 Temperature equipment to maintain temperature from +150°F to +950°F during Hot testing. Temperatures to be accurate within ±10°F.

1.2.4 Thermocouple and indicating unit with ±3°F accuracy for measuring temperatures between -65°F to +300° F and with ±5°F accuracy between +300°F and 950°F.

1.2.5 Temperature cam calibration follower and dial indicator 560000 ET-7.

1.2.6 Gages for taking the following measurements within the specified accuracy.

1. Control propf pressure 0-1500 psi with 1.0% accuracy of full scale reading.
2. Control inlet pressure (Pin): 0-1000 psi with 1.0% accuracy of full scale reading.

HAMILTON STANDARD

SPEC. NO. HS **595 B**

DIVISION OF UNITED AIRCRAFT CORPORATION CODE IDENT NO. 73030

WINDSOR LOCKS, CONNECTICUT, U. S. A.

PAGE 3 OF       **1.2.6** Continued:

3. Control oil pressure (Pout): Two gages Zone 1 and Zone 2: 0-1000 psi with 1.0% accuracy of full scale reading.
4. Control body pressure (Pcb); 0-150 psi with 1.0% accuracy of full scale reading.
5. Total flow throttle valve differential gage ( $\Delta$  PTFTV): 0-80 psi with .75% accuracy of full scale reading.
6. Peak flow throttle valve differential gage ( $\Delta$  PPFTV): 0-150 psi with .75% accuracy of full scale reading.
7. Pump Controller differential gages: 0-200 psi with .75% accuracy of full scale reading.
8. Rig boost pressure (Prb): 0-100 psi with 1.0% of full scale reading.
9. Spare Gages:
  1. 0-600 psi with 0.5% accuracy of full scale reading.
  2. 0-800 psi with 1.0% accuracy of full scale reading.
  3. 0-1000 psi with 1.0% accuracy of full scale reading (2 gages).

**1.2.7** Separate pressure source capable of supplying 200 pph at fuel pressures of 50-750 psig.

**1.2.8** Provisions for testing the control at +350°F Fuel Temperature.

**1.2.9** Back pressure schedule as indicated in Appendix E-1.

**1.2.10** Sanborn Recorder.

**1.2.11** X-Y coordinate plotter.

**1.2.12** Angular position indicator to supply pump control output shaft position input to Sanborn recorder.

**1.2.13** Preliminary Checks

- 1.2.13.1** The fuel control shall be assembled using the shimming procedures in HS 1594. The procedure is to act as a guide only, and may be varied as necessary to satisfy control calibration flow schedule requirements.



H.F-755.1A 5/61

## HAMILTON STANDARD

SPEC. NO. HS 1595 B

DIVISION OF UNITED AIRCRAFT CORPORATION

CODE IDENT NO. 73030

WINDSOR LOCKS, CONNECTICUT, U. S. A.

PAGE 4 OF

1.3 Test Requirements

1.3.1 The following readings shall be recorded at each calibration point.

1. Total Metered Fuel Flow - - - - -Wft
2. Absolute Burner Pressure - - - - - PB
3. Inlet Bulb Temperature - - - - -TT2
4. Power Lever Angle - - - - -PLA
5. Compressor Bleed Position - - - - -CEA
6. Throttle Valve Differential - - - - -T.V.Δ P
7. Pump Controller Differential - - - - -P.C.Δ P

1.3.2 The following readings shall be recorded at the beginning and end of the variable input during calibration.

1. Control Inlet Pressure - - - - -PSIG- - - - Pin
2. Control Outlet Pressure - - - - -PSIG- - - - Pout
3. Test Fluid Temperature - - - - -°F
4. Control Body Pressure - - - - -PSIG- - - - Pcb

1.3.3 The following readings shall be recorded when noted:

1. Zone 1 Fuel Flow - Wf1
2. Zone 2 Fuel Flow - Wf2
3. Peak Fuel Flow - Wfp
4. Arming Signal - PSIG
5. Transfer Point - Wf and PB
6. Pressure in recirculation line PR.

HAMILTON STANDARD

SPEC. NO. HS 1595 B

DIVISION OF UNITED AIRCRAFT CORPORATION

CODE IDENT NO. 73030

WINDSOR LOCKS, CONNECTICUT, U. S. A.

PAGE 5 OF

1.3.4 The following positions, in addition to the foregoing are used in this specification:

1. Clockwise - - - - - CW
2. Counterclockwise - - - - - CCW
3. Military PLA - - - - - MIL (wide open throttle)

1.3.5 Accuracy of settings:

1. PB settings shall be held exact.
2. Tt2 settings shall be held to  $\pm 5^{\circ}\text{F}$
3. WF shall be read exact.

## 2.0 INSPECTION REQUIREMENTS

2.1 The items marked with an asterisk (\*) in this specification are inspection items and as such must be under inspection surveillance.

2.2 Retest Requirements: If settings listed under "Reset" are re-adjusted or if assemblies or parts listed under "Replace" are replaced or removed for repair, the settings listed under corresponding "Retest" must be retested and settings not yet tested must be completed.

### Reset

PB Servo (8.0)  
Temperature Servo (9.0)  
Total Flow T.V. (10.0)  
Zone 2 Transfer (12.0)  
Power Lever (6.1)

### Replace

Servo Housing  
Temperature Servo  
Transfer Housing  
Zone 1 Outlet Housing  
Zone 2 Outlet Housing  
Pump Controller

### Retest

14.1.1, 14.2.1, 14.4.1, 14.4.2,  
14.1.1, 14.4.1, 14.4.2,  
14.1.1, 14.2.1, 14.4.1, 14.4.2,  
14.5.1, 14.5.2  
6.2, 6.3

### Retest

8.0, 14.1.1, 14.2.1, 14.4.1, 14.4.2,  
9.0, 14.1.1, 14.4.1, 14.4.2,  
12.0, 14.5.1, 14.5.2  
14.8.2.1, 14.8.2.2  
14.6.1, 14.8.1.3, 14.8.2.1, 14.8.2.2  
7.1, 7.2.1, 7.2.2

2.3 No adjustments or changes in parts shall be permitted during the final, inspected, test of the control.

3.0 INSTALLATION INSTRUCTIONS

3.1 Install control manifold in a position similar to normal engine mounted position (Ref. P & W layout 203578), connect Pump Discharge to Control Inlet both outlets must be connected to separate flowmeters. Recirculation and Internal Leakage lines must also be connected to separate flowmeters.

3.2 Install 80 psi differential gage across the total flow throttle valve, 150 psi across peak throttle valve, also install 200 psi differential gage across the total flow T.V. and inline regulator.

3.3 Install a separate fuel pressure source to the speed signal valve.

3.4 Make sure that there are no open fittings on control and the internal leakage line is not "dead headed."

3.5 The flowmeter density adjustments shall be set in accordance with actual density measurements during both ambient and hot fuel tests.

4.0 EXTERNAL LEAKAGE

4.1 With PLA at Max Wf, set boost pump pressure to  $60 \pm 15$  psig. There shall be no external leakage except:

- a) No more than 10DPM from the PB drain.
- b) No more than 30DPM from the Pump Controller Drain.

The term "no leakage" shall be defined as the permissible visual appearance of fluid on the external surface of a control which does not become progressively greater during a 5 minute period to such a degree that fluid runs off the surface of the control or forms droplets.

5.0 PROOF PRESSURE TEST

\* 5.1 With PLA at max., increase Wf to  $10,000 \pm 500$  PPH. Close outlet valve until pin is  $1500 \pm 20$  psi. Maintain this pressure for a time period not to exceed 1 minute. There shall be no external leakage. Open outlet valve. The term "no leakage" shall be applied as defined in paragraph 4.1.

6.0 POWER LEVER SEQUENCE

6.1 Increase power lever angle until a position is reached where the PL Servo Piston moves .001-.005. Lock PL in place and adjust protractor slip ring until it reads  $67^\circ$ . At this position adjust the stop plate until the hole in the stop plate lines up with the slot in the index ring. Be sure protractor or slip ring and stop plate are locked in position.

CAUTION: Be sure PL Servo piston is not hitting the min line stop (cover or screw in cover) when finding the .001 - .005 motion position. Check by turning PLS position adj. cw until servo moves at least .020.

## HAMILTON STANDARD

SPEC. NO. HS 1595 B

DIVISION OF UNITED AIRCRAFT CORPORATION CODE IDENT NO. 78983

WINDSOR LOCKS, CONNECTICUT, U. S. A.

PAGE 7 OF

- 6.2 Set PLA = Max, PB = 15. Decrease PLA to 0°. Apply 150 psig to speed signal valve. Increase PLA to 67°. Adjust T.O.P.V. cam until the recirculation valve closes and the Zone I S.O.V. is open.

CAUTION: Torque on adjusting screws to be 15-20 in-lbs.

7.0 PUMP CONTROLLER CALIBRATION

- 7.1 Set PLA = max., PB = 18. Adjust spring pre-load on pilot valve until P1 - P3 is 100 ± 2 psi. Repeat at PB = 50 & 100 differential pressure must remain at 100 ± 5 psi.

7.2 DYNAMIC PERFORMANCE

\*7.2.1 Integral Rate

- 7.2.1.1 Disconnect the pump control shaft from the stand output flow control. Install the fixtures necessary to make Sanborne traces of pump control output shaft angle and  $\Delta P_{1-3}$ . Set PLA at 120°, Tt2 at 59°F., PB at 100 psia, Bleeds closed.

- 7.2.1.2 Adjust the stand output flow control to create a  $\Delta P_{1-3}$  of 105 psi. When P.C. output shaft is near the center of its stroke make a step change to decrease  $\Delta P_{1-3}$  such that it is 5 to 9 psi below the P.C. setting. Obtain at least two sanborne recordings of this transient.

- 7.2.1.3 Put P.C. output shaft near the center of its stroke by varying  $\Delta P_{1-3}$ , then make a step change to increase  $\Delta P_{1-3}$  such that it is 5 to 9 psi above the P.C. setting. Get sanborne recordings of this transient.

- 7.2.1.4 The integration rate of the P.C. output shaft shall be between 0.1 and 0.3 degrees per psi error per second.

\*7.2.2 Slew Rate Position

Disconnect Pump Controller Shaft from stand output flow control. Set PLA at 120°, Tt2 at 59°F., Pb at 100 PSIA, bleeds closed, adjust stand output flow to decrease  $\Delta P_{1-3}$  the amount necessary to cause the Pump Controller Arm to move at its "Slew Rate".  $\Delta P_{1-3}$  to get this slew rate shall be 18 to 22 psi below the Pump Controller setting. Shim under proportional piston spring to meet this requirement (Ref. Fig. 31, HS 1591). Maximum number of shims shall not exceed 130. If maximum shim thickness is exceeded, replace spring under the feedback piston with a lower dash numbered spring.

\*7.2.3 Slew Rate

Disconnect pump controller shaft from stand output flow control. Set PLA at 120°, TT2 at 59°F., Pb at 100 psia, bleeds closed: adjust motor control to create  $\Delta P_{1-3}$  of 105 psi. Obtain a transient recording of  $\Delta P_{1-3}$  and pump controller output shaft angular position while making a rate change of 5 psi/sec (max) to decrease  $\Delta P_{1-3}$  25 to 30 psi below the pump controller setting. The angular rate of the pump controller output shaft shall be at least 90° per second.

- 7.3 Set PLA = max. Increase PB until Wf = 25000 PPH. Adjust sensor for inline regulator until differential across total flow T.V. is 40 psi.

## HAMILTON STANDARD

SPEC. NO. HS 1595B

DIVISION OF UNITED AIRCRAFT CORPORATION

CODE IDENT NO. 73030

WINDSOR LOCKS, CONNECTICUT, U. S. A.

PAGE 8 OF

8.0 PB SERVO CALIBRATION

NOTE: Refer to Build-up Sheet for Dim. K L-7208-12. If Dim. K is Plus (+) add this amount to the below PB pressures.

- 8.1 Set PLA =  $68^{\circ}$ , increase PB to  $30 \pm K$ , bleeds closed. Adjust PB position adjustment until cam follower is in bottom of the detent on the PB cam.

NOTE: Bottom of detent is determined by change of motion on dial indicator. Bottom of detent is located at point where indicator reverses direction no more than ( $\pm .0001$ ).

- 8.2 Increase PB to  $215 \pm K$ . Shim C.B.A. pushrod until cam follower is in bottom of high PB detent.

- 8.3 Repeat 8.1 and 8.2 until detents are set.

9.0 TEMPERATURE SERVO CALIBRATION

- 9.1 Set PB =  $30 \pm K$ , PLA = max, Tt2 =  $-65^{\circ}\text{F}$ , bleeds closed. Adjust position spring on the Tt2 input lever until the cam calibration follower just starts to come out of the detent ( $\pm .0001$ ).

- 9.2 Set PB =  $30 \pm K$ , PLA = Max. Tt2 =  $+950^{\circ}\text{F}$ , bleeds closed. Adjust rate spring on the flapper until the cam calibration follower just starts to come out of the detent ( $\pm .0001$ ).

- 9.3 Repeat items 9.1 and 9.2 until the detents are set.

10.0 TOTAL FLOW THROTTLE VALVE CALIBRATION

- 10.1 Set PB = 50, PLA =  $68^{\circ}$ , Tt2 =  $59^{\circ}\text{F}$ , bleeds closed. Record total flow T.V. displacement and total metered flow. Increase PB until disp. changes .100. (T.V. rate is 95.4 PPH/.001). Wf must change by 9540 PPH  $\pm$  100 PPH. Adjust inline sensor  $\Delta P$  until set.

- 10.2 Bleeds closed, PLA = 0, Tt2 =  $+59^{\circ}\text{F}$ , PB = 200. Recirculation flow must be 3000 PPH. Adjust minimum flow stop until this Wf is obtained.

## HAMILTON STANDARD

SPEC. NO. HS 1595B

DIVISION OF UNITED AIRCRAFT CORPORATION

CODE IDENT NO. 73030

WINDSOR LOCKS, CONNECTICUT, U. S. A.

PAGE 9 OF

- 10.3 Set bleeds closed, Tt2 = 65°F. Set PLA = max and read Wf at 50 & 90 PB. Then set PLA = min and read Wf at 75 & 150 PB. Plot these readings. A straight line drawing thru 50 & 90 on the max line and 75 & 150 on the min line must intersect at 2.75 PSIA and -200 PPH. The actual intersection will be defined by finite values of Wf and PB (Wf and Pb error).
- 10.4 Bleeds closed, Tt2 = -65°F, PB = 30, PLA = max. Adjust T. V. multiplying lever hinge until Wf error is reduced to -200 pph.
- 10.5 If data lines determined in 10.3 do not intersect at -2.75 psia it will be necessary to reshim the T.V. multiplying lever hinge. Approx. .006 shims will change intercept 1 psi. Adding shims will move intercept to left (minus).
- 10.6 PLA = 67°, PB = 100, Tt2 = +59°F, bleeds closed. Adjust power lever servo pilot valve position until Wf = 7420 PPH.
- \*10.6.1 Set PLA = max, PB = 100, Tt2 = -65°F, bleeds closed. Record Wf. Increase Tt2 to +300°F and record Wf. Differential Wf between -65°F and +300°F must be 6700 ± 250 PPH. Adjust the Tt2 cam bias adjustment until this differential is obtained. Set PL rate adj. to center of its travel before setting Tt2 ball follower adj. screw.
- 10.7 Set PLA = max, PB = 100, Tt2 = -65°F, bleed closed. Adjust the power lever rate adjust (linkage bracket) until Wf = 43000 PPH. At this time check stroke of the power lever servo. Stroke must be .900 ± 100 for full power lever movement.
- 10.8 Recheck 10.6 and 10.7, as slight trimming adjustment may be necessary.
- \*10.8.1 Range of Remote Trim adjustment (PL Servo Rate):  
Set PB = 100; Tt2 = -59°F; PLA = Max. Turn adjustment clockwise until it bottoms and record total Wf. Turn adjustment ccw until it bottoms and record total Wf. Limits: Adjustment range must be at least 14% of Wf as calibrated. Range determined with this check must be recorded on the final data sheet. Note: Do not repeat this test during final calibration.
- 10.9 Set PB = 100, Tt2 = +59°F bleeds closed. At these conditions increase PLA until Wf is 13300 PPH. Adjust power lever stop to contact piston at this flow.
- 10.10 Bleeds closed, Tt2 = -65°F, Repeat 10.3. Adjust T.V. multiplying lever hinge until the intercept occurs at -2.75 psia and +5,900 PPH.
- 10.11 Set PB = 23 psia; PLA = 120°, Tt2 = +750°F; bleeds closed. Wf must be 12078-12698 pph. Trim to obtain this Wf by a P.L. servo position adjustment.
- 11.0 POWER LEVER TORQUE
- 11.1 Maximum Power Lever Torque throughout the operating range shall be no greater than 20 in-lbs.
- 12.0 ZONE 2 MANIFOLD TRANSFER

## HAMILTON STANDARD

SPEC. NO. HS 1595B

DIVISION OF UNITED AIRCRAFT CORPORATION

CODE IDENT NO. 73030

WINDSOR LOCKS, CONNECTICUT, U. S. A.

PAGE 10 OF

12.1 Pressure in "Y" line must build up to within 10% of its final value within 25 seconds measured from the time it starts to increase. Select bleed size to meet this requirement.

12.2 Set PLA = 65°, PB = 50, Tt2 = +59°F, bleeds closed. Increase PLA and determine actuation point of the Zone 2 manifold. The Zone 2 manifold must actuate at 14490-16010 pph. Note: Adjust the C.D.P. transfer power spring to set the correct rate.

12.2.1 If transfer position cannot be set by procedure of para. 12.2 it will be necessary to use the T.V. yoke adjustment. Clockwise adjustment lowers position.

12.3 Set PLA = 65°, PB = 20, Tt2 = +59°F, bleeds closed. Increase PB = 100. Increase PLA and determine actuation point of the Zone 2 manifold. The Zone 2 manifold must actuate at 28975-32025. Note: Adjust the C.D.P. transfer power spring to set the correct rate. Adjust the T.V. transfer power spring to set the correct position.

12.4 Check retransfer (Zone 1 closes on decreasing PL) according to note in Appendix D-1.

### 13.0 PEAK THROTTLE VALVE RATE

13.1 Set PLA = 120°, PB = 50, Tt2 = +59°F, bleeds closed. Record Wf in Zone 1. Increase PB to 150 and record Wf in Zone 1. Difference in Wf between 50 and 150 PB must be 25000-26000 PPH. Adjust peak valve sensor until this difference is obtained.

13.2 Plot peak line with bleeds closed. Intercept with fuel flow axis, at PB = 0 psia, should not be off more than 300 PPH in either direction. If intercept is off more than ± 300 PPH, reshim 3-D cam to correct error. (Wf error/28 = shims).

### 14.0 FINAL CALIBRATION

- Note:
- \*1. A body pressure of 50 ± 20 psig shall be maintained throughout final calibration.
  - \*2. No adjustments or changes of parts shall be permitted during the final calibration.
  - \*3. Prior to final calibration all external screws which affect calibration settings shall be lockwired.

14.1 MAX RATIO CALIBRATION - BLEED CLOSED

\*14.1.1 Set PLA = 120°, Tt2 = +59°F, bleeds closed. Record total metered Wf, T.V. ΔP, and P.C. ΔP at the following PB pressures (Note: Approach PB pressures in increasing direction.) PB=15, 20, 40, 60, 75, 85, 100, 120, 145, 180, 145, 85, 40, 20 and 15 psia. Appendix A-1 for limits. Hysteresis must be within 3000 PPH of observed increasing value. Record return to Pump Inlet Flow at 20 & 180 psia. Do not overshoot when setting PB pressures.

## HAMILTON STANDARD

SPEC. NO. HS 155B

DIVISION OF UNITED AIRCRAFT CORPORATION

CODE IDENT NO. 73030

WINDSOR LOCKS, CONNECTICUT, U. S. A.

PAGE 11 OF

- \*14.1.2 Set PLA = 120°, bleeds closed, PB = 100 psia, Tt2 less than 20°F. Increase Tt2 to 59°F, allow to stabilize for at least one minute and record fuel flow. Increase Tt2 to 150°F, hold for at least one minute, then reduce it to 59°F. Allow one or more minutes to stabilize and record fuel flow. Limits shall be as defined in appendix A-1 for PB = 100 psia.

14.2 MIN RATIO CALIBRATION - BLEEDS CLOSED

- \*14.2.1 Set PLA = 68°, Tt2 = +59°F, bleeds closed. Record total metered Wf, T.V. ΔP, and P.C. ΔP at the following PB pressures 20, 40, 100, 180, 100, 40, and 15 psia. See appendix B-1 for limits. Hysteresis must be within the limits defined in appendix B-1. (Note: Do not overshoot when setting PB pressures.)

14.3 POWER LEVER SEQUENCE AND TRANSIENT

- \*14.3.1 Set PLA = 120°, Tt2 = +59°F, PB = 18, bleeds closed. Decrease PLA to 0° then slowly increase PLA. At 66° - 67° the recirculation valve must close at or after the time at which the Zone I manifold S.O.V. opens. Increase PLA to 120°. Slowly decrease PLA and record PLA at which S.O.V. closes. PLA must be within 65° - 67° when S.O.V. closes. Recirculation valve must open at or before the time at which the S.O.V. closes.
- \*14.3.2 Set arming signal at 0 to 50 psig, PLA = 0, Tt2 = 59°F, PB = 20 psia. Now advance the power lever to approximately 75°. Slowly increase arming signal pressure until the S.O.V. opens and record this pressure. Limits: The pressure must be between 30 and 110 psig above body pressure.
- \*14.3.3 Set Pb = 100 psia and Tt2 = +59°F. Change PLA from 67° to 120° within .8 to 1.2 seconds. The control fuel flow shall increase at a rate not to exceed 300 Wf/Pb ratios per second and complete 90% of the transient in 2 seconds or less.
- \*14.3.4 Set Pb = to 100 psia and Tt2 = to +59°F. Change PLA from 120° to 67° within .8 to 1.2 seconds. The control fuel flow shall complete 90% of the transient in 2 seconds or less.
- \*14.3.5 Set Pb = 100 psia and Tt2 = +59°F. Bleeds closed. Maximum Power Lever Torque throughout the operating range shall be no greater than 20 in-lbs.

14.4 TEMPERATURE (Tt2) SENSING CALIBRATION - (See Appendix C-1 for Limits)  
NOTE: All temperatures (Tt2) to be actual bulb temp. for final calibration.

- \*14.4.1 Set PLA = max, Tt2 = -65°F, bleeds closed. Record total metered Wf at the PB pressures noted in Appendix C-1. (Note: Approach PB pressures in increasing direction).
- \*14.4.2 Repeat item 14.4.1 at temperatures (Tt2) of +150°F, +300°F, +550°F, +750°F.



HAMILTON STANDARD

SPEC. NO. HS 1595B

DIVISION OF UNITED AIRCRAFT CORPORATION

CODE IDENT NO. 73030

WINDSOR LOCKS, CONNECTICUT, U. S. A.

PAGE 12 OF

- \*14.4.3 The force required to open and close CBA pushrod shall not exceed 20 lbs, when body pressure is at 50 psig.

14.5 MANIFOLD TRANSFER AND PEAK SYSTEM CALIBRATION

- 14.5.1 In the following calibration record Zone I Fuel Flow ( $W_{f1}$ ) at the manifold transfer points. A coordinate system plotter (X, Y) is required for this calibration. A plot of  $W_{f1}$  vs PB shall be made for all calibration points. An indication must appear on the chart when the Zone II regulator opening pressure increases a minimum of 50 psi above control body pressure. This pressure increase indication must occur within the transfer limits defined in Appendix D-1. At each of the specified PB settings decrease  $P_{br}$  from max at a rate no faster than 2°/sec until retransfer occurs. Retransfer shall occur within the limits specified in Appendix D-1.

HSF-755.1A 5/61

## HAMILTON STANDARD

SPEC. NO. HS 1500B

DIVISION OF UNITED AIRCRAFT CORPORATION

CODE IDENT NO. 73000

WINDSOR LOCKS, CONNECTICUT, U. S. A.

PAGE 13 OF

14.5.2 Set PLA = 68°, PB = 20, Tt2 = +59°F, bleeds closed. Increase PLA no faster than 2°/sec. record transfer and peak flow points at PB of 20, 30, 50, 100, 150 and 180. See Appendix D-1 for limits.

14.6.0 RECIRCULATION CALIBRATION

\*14.6.1 Set PLA = 0°, PB = 100 psia, Tt2 = +59°F, bleeds closed. Metered WF must be 2850 - 3150 pph. Record control inlet pressure and control body pressure. Control inlet pressure must be within 80-200 psi above control body pressure.

14.7.0 REPEATABILITY CHECKS

\*14.7.1 Check repeatability in accordance with and in sequence indicated in Appendix F-1.

14.7.2 Re-run per paragraph 14.7.1 two additional times. Re-run paragraph 14.7.1 a total of 9 additional times only if requested by HS Engineering. Cycle bleeds open to bleed closed twice before starting each re-run.

14.8.0 LEAK CHECK

\*14.8.1 With all instrumentation removed from control, set the PLA at 120°, set PB at 150 psia, Tt2 at +59°F bleeds closed.

\*14.8.1.1 Check external leakage. No leakage allowed except for overboard drain and PB drain.

The term "no leakage" shall be defined as the permissible visual appearance of fluid on the external surface of a control which does not become progressively greater during a 5 minute period to such a degree that fluid runs off the surface of the control or forms droplets.

\*14.8.1.2 Check overboard drain leakage. Allowable leakage shall be no more than 10 dpm from the PB drain and 30 dpm from the pump controller drain.

\*14.8.1.3 Remove recirculation line from the control and check recirculation valve leakage. Leakage from the recirculation port must not exceed 20 cc/min.

\*14.8.1.4 Pressurize overboard drain port on pump controller to 10 psig. The external leakage shall not be greater than 8 drops per minute per seal.

\*14.8.2 Shut-Off Valve Leakage

Note: Allow ten minutes for lines to drain before taking leakage reading.

\*14.8.2.1 Set PLA = 0°, Tt2 = +59°F, PB = 15, bleeds closed, with main and boost pumps operating. Remove zone I and zone II outlet lines. Leakage in zone I and zone II must not exceed 10 dpm in either line. Shut down main pump.

## HAMILTON STANDARD

SPEC. NO. HS 1

DIVISION OF UNITED AIRCRAFT CORPORATION

CODE IDENT NO. 71

WINDSOR LOCKS, CONNECTICUT, U. S. A.

PAGE 14 OF     

\*14.8.2.2 Set PLA = 0°, Tt2 = +59°F, PB = 15. Maintain Boost Pressure at 50 psig. Remove Zone I and Zone II outlet lines. Leakage must not exceed 20 dpm in either line.

14.9.0 Power Lever Cam Calibration Check

\*14.9.1 Set PB of 100 PSIA; Tt2 = +59°F. Set, in sequence, power lever angles of 67°, 75°, 85°, 95°, 105°, 120°, 95°, 75°, 67°. Record total Wf at each point.

\*14.10.0 The "K" dimension used in setting up the PB system position must be recorded on the final data log sheets.

14.11 HOT TEST REQUIREMENTS

14.11.1 The following items shall be run three times in the following sequence. First with fuel temperature at 100 ± 5°F, then with fuel temperature at 325 - 350°F, then with fuel temperature at 100 ± 5°F. All runs are to be made at room temperature ambient conditions.

\*14.11.1.1 Set PLA at 120°, Tt2 at +300°F and bleeds closed. Record total flow at the following CDP pressures: 20, 60 & 100 PSIA. Note: Set CDP in the increasing pressure direction. See Appendix C-1 for limits.

\*14.11.1.2 Set PLA at 120°, Tt2 at +750°F and bleeds closed. Record total flow at the following CDP pressures: 20, 30, 50, 100 hysteresis 50 and 30 psia. See Appendix C-1 for limits.

14.11.2 Repeat para. 14.1.2 to be sure speed signal valve is still operative.

15.0 PRESERVATION AND STORAGE

15.1 At conclusion of bench calibration, drain the calibrating fluid from the control and prepare the control for shipment in accordance with H. S. Spec. 380.

NOTE: Controls which have been insulated prior to running final bench calibration data must be heated in a ventilated oven at 250° ± 10°F for a period of 1 to 1½ hours after draining calibrating fluid from the control.

\*15.2 The "dry" weight of the control shall be recorded on the installation inspection sheet.

## HAMILTON STANDARD

SPEC. NO. HS 1595B

DIVISION OF UNITED AIRCRAFT CORPORATION

CODE IDENT NO. 73030

WINDSOR LOCKS, CONNECTICUT, U. S. A.

PAGE 15 OF

APPENDIX A-1

<u>PB</u>	<u>Conditions</u>	<u>Total Wf Limits</u>
15		Record Wf Value Only
20	Tt2 = +59°F	11020 - 12180
40	Bleeds	15900 - 17600
60	Closed	20900 - 23200
75		24800 - 27400
85	PLA = 120°	28700 - 31800
100		34500 - 38200
120		40500 - 44800
145		42500 - 47000
180		51000 - 56500

APPENDIX B-1

<u>PB</u>	<u>Conditions</u>	<u>Total Wf Limits</u>
15		Record Wf Value Only
20	Tt2 = +59°F	7680 - 8520
40		9760 - 10800
100	Bleeds closed	16000 - 17800
180	PLA = 68°	24200 - 26800

APPENDIX C-1Temperature Sensing Calibration

Tt2 = -65°F B.C.

Tt2 = +300°F B.C.

<u>PB</u>	<u>Total Wf Limits</u>	<u>PB</u>	<u>Total Wf Limits</u>
15	Record Wf Value Only	15	Record Wf Value Only
20	11660 - 12900	20	11180 - 12360
60	24800 - 27400	60	22200 - 24600
100	38200 - 42200	100	33000 - 36500
150	52900 - 58500	150	47100 - 52100
180	53800 - 59500	180	54200 - 59900

Tt2 = +150°F B.C.

Tt2 = +550°F B.C.

<u>PB</u>	<u>Total Wf Limits</u>	<u>PB</u>	<u>Total Wf Limits</u>
15	Record Wf Value Only	15	Record Wf Value Only
20	10880 - 12040	20	11100 - 12280
60	21200 - 23400	60	23900 - 26400
100	32500 - 35900	100	35800 - 39700
150	44500 - 49300	150	51300 - 56700
180	52600 - 58200	180	53800 - 59500

## HAMILTON STANDARD

SPEC. NO. HS 1595B

DIVISION OF UNITED AIRCRAFT CORPORATION

CODE IDENT NO. 73030

WINDSOR LOCKS, CONNECTICUT, U. S. A.

PAGE 16 OF

APPENDIX C-1 (cont.)

Tt2 = +750°F, B.C.

<u>PB</u>	<u>Total Wf Limits</u>
15	Record Wf Value Only
20	11220 - 11820
30	14260 - 15000
50	20800 - 22100
100	33800 - 37400
150	48000 - 53100
180	53800 - 59500

Note: Hysteresis Wf must be within specified limits.

APPENDIX D-1

<u>PB</u>	<u>Transfer Wf B.C.</u>	<u>Peak Wf B.C.</u>
20	5795 - 6405	4845 - 5255
30	8690 - 9610	7265 - 8035
50	14490 - 16010	12110 - 13390
100	28975 - 32025	24225 - 26775
150	43460 - 48040	36340 - 40160
180	52150 - 57650	43600 - 48200

Note: On decreasing PL expansion the control must retransfer within the following limits:

- A) At PB values of 50 psia or less retransfer must occur at least 200 PPH below but no greater than 500 PPH below the increasing Transfer Fuel Flow.
- B) At PB values above 50 psia retransfer must occur at least 200 PPH below but no greater than 10 ratio units below the increasing Transfer Fuel Flow.

APPENDIX E-1

<u>Wf</u>	<u>Zone I Injection Manifold</u> (psf)
3000	90 - 110
6000	140 - 165
10000	195 - 225
20000	300 - 345
30000	390 - 440
40000	460 - 520

## HAMILTON STANDARD

SPEC. NO. HS 1595B

DIVISION OF UNITED AIRCRAFT CORPORATION

CODE IDENT NO. 73030

WINDSOR LOCKS, CONNECTICUT, U. S. A.

PAGE 17 OF

APPENDIX F-1

	(PSIA) PB	Conditions	Total PPH Wf Limits	PPH Peak Wf Limits
1)	60 150	(Tt2 = -65°F B.C.) PLA = 120°	24800 - 27400 52900 - 58500	14535-16065 36340-40160
2)	40 180	(Tt2 = -65°F B.C.) PLA = 68°	9760 - 10800 24200 - 26800	
3)	30 150	Transfer per paragraph 14.5.2	8690 - 9610 43460-48040	
4)	20 150	(Tt2 = 150°F B.C.) PLA = 120°	10880 - 12040 44500 - 49300	

**Page Denied**

## HAMILTON STANDARD

DIVISION OF UNITED AIRCRAFT CORPORATION

WINDSOR LOCKS, CONNECTICUT, U. S. A.

SPEC. No. HS 1373B

Page 2 of

CODE 73030

1.0 GENERAL INFORMATION1.1 Scope

This specification covers the method for testing the model JFC51 Afterburner Fuel Control 568400.

1.2 Equipment Required

Flow bench with a boost pump capable of supplying 10-70 psig fuel pressure to the main pumps in a closed loop system of operation. Main pumps capable of supplying 65000 PPH at 1000 psig pump discharge pressure. Two metered flow meters; Zone 1 and Zone 2. Zone 1 meter must be accurate to 0.5% in the 3000 PPH to 50000 PPH range and the Zone 2 meter must be accurate to 0.5% in the 1500 25000 PPH range. A recirculation line flowmeter accurate to 1.0% in the 350 5000 PPH range. An internal leakage flowmeter accurate to 2.0% in the 350 3000 PPH range. Pump discharge pressure to be controlled as a function of pump controller output thru a system of relief valves in pump discharge line.

1.2.1 Test fluid will be Bayol "D" or P&WA 523. Maintain control inlet and flow meter inlet at  $95^{\circ} \pm 5^{\circ}\text{F}$ .

1.2.2 Pneumatic pressure source and two gages for simulating engine burner pressure capable of maintaining for a minimum period of 0.5 hour any pressure between 10 and 300 PSIA. One gage 0 to 50 psia accurate to  $\pm 0.1$  psia, another gage 0 to 300 psia accurate to  $\pm 0.25$  psia over a range of 50 to 300 psia.

1.2.3 Constant temperature baths capable of maintaining temperatures of  $-65^{\circ}$ ,  $0^{\circ}$ ,  $+60^{\circ}$ , and  $+150^{\circ}$ .

1.2.3.1 Equipment to simulate temps. higher than  $250^{\circ}\text{F}$ . such as a pressure bellows fixture, dead weight fixture, or other suitable fixture to simulate actual Tt2 motor diaphragm assembly force input.

1.2.3.2 Temperature equipment to maintain temps. from  $-65^{\circ}\text{F}$ . to  $+950^{\circ}\text{F}$ . during hot testing.

1.2.4 Thermocouple and indicating unit with  $\pm 3^{\circ}\text{F}$ . accuracy for measuring temperatures between  $-65^{\circ}\text{F}$ . to  $+300^{\circ}\text{F}$ . and  $\pm 5^{\circ}\text{F}$ . accuracy between  $+300^{\circ}\text{F}$ . and  $950^{\circ}\text{F}$ .

1.2.5 Temperature cam calibration follower and dial indicator 560000 ET-7.

1.2.6 Gages for taking the following measurements within the specified accuracy.

1. Control proof pressure: 0-1500 psi with 1.0% accuracy of full scale reading.
2. Control inlet pressure (Pin): 0-1000 psi with 1.0% accuracy of full scale reading.
3. Control outlet pressure (Pout): Two gages Zone 1 and Zone 2: 0-1000 psi with 1.0% accuracy of full scale reading.



F-755.1 8754

HAMILTON STANDARD  
DIVISION OF UNITED AIRCRAFT CORPORATION  
WINDSOR LOCKS, CONNECTICUT, U. S. A.

SPEC. No. HS 1373B  
Page 3 of

CODE 73330

1.2.6.

Continued:

4. Control body pressure (Pcb): 0-150 psi with 1.0% accuracy of full scale reading.
5. Total flow throttle valve differential gage ( $\Delta$  PTFTV): 0-80 psi with .75% accuracy of full scale reading.
6. Peak flow throttle valve differential gage ( $\Delta$  PPFTV): 0-80 psi with .75% accuracy of full scale reading.
7. Pump Controller differential gage: 0-200 psi with .75% accuracy of full scale reading.
8. Rig boost pressure (Prb): 0-100 psi with 1.0% of full scale reading.
9. Spare Gages:
  1. 0-600 psi with 0.5% accuracy of full scale reading.
  2. 0-800 psi with 1.0% accuracy of full scale reading.
  3. 0-1000 psi with 1.0% accuracy of full scale reading (2 gages)

1.2.7

Separate pressure source capable of supplying 200 PPH at fuel pressures of 50-750 psig.

1.2.8

Provisions for static testing the control at  $+45^{\circ}\text{C}^{\circ}\text{F}$ . Fuel Temperature.

1.2.9

Back pressure schedule as indicated in Appendix E-1.

1.2.10

Equipment to apply A 45-50 in.# CCW torque to the pump control shaft.

1.2.11

Preliminary checks

1.2.11.1

The fuel control shall be assembled using the shimming procedures in Appendix F of this specification. This procedure is to act as a guide only and may be varied as necessary to satisfy control calibration flow schedule requirements.

1.2.11.2

All valves must be stroked in their mating bores through at least 100 cycles according to the stroke requirements listed in Appendix G. During cycling, valve outside diameter and mating bore surfaces are to be lubricated with Dominion A Spindle Oil obtainable from Atlantic Refining Co., 1351 Main Street, East Hartford, Connecticut, or its equivalent.

Note: One cycle consists of moving the valve from its original position through the desired stroke, and then returning the valve to the original position.

Caution: During cycling, valve should not strike bottom of bore nor be withdrawn from its mating bore in a manner that would damage valve sharp edges.

## HAMILTON STANDARD

DIVISION OF UNITED AIRCRAFT CORPORATION

WINDSOR LOCKS, CONNECTICUT, U. S. A.

SPEC. No. HS 1373B  
Page 4 of

CODE 73030

1.3 Test Requirements

1.3.1 The following readings shall be recorded at each calibration point.

1. Total Metered Fuel Flow- - - - - Wft
2. Absolute Burner Pressure - - - - - PB
3. Inlet Bulb Temperature - - - - - TT2
4. Power Lever Angle- - - - - PLA
5. Compressor Bleed Position - - - - - CBA
6. Throttle Valve Differential - - - - - T.V. Δ P
7. Pump Controller Differential - - - - - P.C. Δ P

1.3.2 The following readings shall be recorded at the beginning and end of the variable input during calibration.

1. Control Inlet Pressure - - - - - PSIG - - - - - Pin
2. Control Outlet Pressure - - - - - PSIG - - - - - Pout
3. Test Fluid Temperature - - - - - °F
4. Control Body Pressure - - - - - PSIG - - - - - PcB

1.3.3 The following readings shall be recorded when noted:

1. Zone I Fuel Flow - Wf - Wf1
2. Zone 2 Fuel Flow - Wf - Wf2
3. Peak Fuel Flow - Wf - Wfp
4. Arming Signal - PSIG
5. Transfer Point - PLA

1.3.4 The following abbreviations, in addition to the foregoing are used in this specification:

1. Clockwise - - - - - CW
2. Counterclockwise - - - - - CCW
3. Military PLA- - - - - MIL (wide open throttle)
4. Idle PLA - - - - - 1° Above Shut-off

MS 1-755.1 8/54

HAMILTON STANDARD

DIVISION OF UNITED AIRCRAFT CORPORATION

WINDSOR LOCKS, CONNECTICUT, U. S. A.

SPEC. No. HS 1373B

CODE 73030

Page 5 of

1.3.5 Accuracy of settings:

1. Pb settings shall be held exact.
2. Tt2 settings shall be held to  $\pm 5^{\circ}\text{F}$ .
3. Wf shall be read exact.

2.0 INSPECTION REQUIREMENTS

- 2.1 The items marked with an asterisk (\*) in this specification are inspection items and as such must be under inspection surveillance.

2.2

Retest Requirement: If settings listed under "Reset" are re-adjusted or if assemblies or parts listed under "Replace" are replaced or removed for repair, the settings listed under corresponding "Retest" must be retested and settings not yet tested must be completed.

ResetRetest

Hy. Servo (8.0)  
Temperature Servo (12.0)  
Total Flow I.V. (12.0)  
Zone 2 Transfer (12.0)  
Power Lever (6.1)

14.1, 15.1, 16.1, 17.1, 19.1, 19.2, 19.3  
14.1, 19.1, 19.2, 19.3  
14.1, 15.1, 16.1, 17.1, 19.1, 19.2, 19.3  
20.2, 20.3, 20.4  
18.1

ReplaceRetest

Servo Housing  
Temperature Servo  
Transfer Housing  
Zone 1 Outlet Housing  
Zone 2 Outlet Housing  
Pump Controller

8.0, 14.1, 15.1, 16.1, 17.1, 19.1, 19.2, 19.3  
9.0, 14.1, 19.1, 19.2, 19.3  
12.0, 20.2, 20.3, 20.4  
22.1, 22.2  
22.1, 22.2, 23.1  
7.1

3.0

INSTALLATION INSTRUCTIONS

3.1

Install control in control table, connect pump discharge to control inlet, all two outlets must be connected to separate flow meters. Recirculation and internal leakage lines must also be connected to separate flow meters.

3.2

Install 50 psi differential gages across the total flow throttle valve and the peak throttle valve, also install 200 psi differential gage across the total flow I.V. and inline regulator.

3.3

Install a separate fuel pressure source to the speed signal valve.

3.4

Make sure that there are no open fittings on control and the internal leakage line is not "dead headed".

3.5

Index protractor 560000 ET-1 so that the calibrating pin will slip thru the protractor, index ring and stop plate at  $53^\circ \pm 15'$  below the max A/B stop.

3.5.1

Determine max A/B stop, decrease power lever  $53^\circ$  from this point. Insert index pin thru the protractor and index ring, if it doesn't engage hole in the stop plate, slip the stop plate until all three holes are lined up and the indexing pin can be inserted. Protractor must read  $67^\circ$  at this point. If necessary slip protractor face until  $67^\circ$  on protractor and scribe on dial are in line. Lock protractor and stop plate in place.

3.6

The flowmeter density adjustments shall be set in accordance with actual density measurements during hot fuel tests.

HAMILTON STANDARD

DIVISION OF UNITED AIRCRAFT CORPORATION

WINDSOR LOCKS, CONNECTICUT, U. S. A.

SPEC. No. HS 1373B

Page 7 of

CODE 73030

4.0: EXTERNAL LEAKAGE

- \*4.1 With PLA at max A/B, set boost pump pressure to  $60 \pm 5$  psig. There must be no external leakage, and no more than 10 dpm from the Pb drain and 30 dpm from the pump controller drain.

5.0 PROOF PRESSURE TEST

- \*5.1 Set PLA; Max. increase Wf to  $10,000 \pm 500$  PPH. Close down on outlet valve until Pin -  $1500 \pm 20$  psi (do not hold over 1 minute at this pressure). Check for external leakage. No leakage allowable. Open outlet valve.

6.0 POWER LEVER SEQUENCE

- 6.1 Set PLA = Max. Pb = 15. Decrease PLA to 0°. Apply 150 psig to speed signal valve. Increase PLA to 67°. Adjust T.O.P.V until the recirculation valve closes and the Zone I S.O.V. is open. Determine actuation by noting that when increasing the power lever the signal pressure to the recirculation valve is Pin to Pin - 20 psi, and the signal pressure to the Zone I S.O.V. is PBody to PBody + 20 psi.

7.0 PUMP CONTROLLER CALIBRATION

- 7.1 Set PLA = max. Pb = 15. Adjust spring pre-load on pilot valve until pressure differential between sensor inlet pressure is  $75 \pm 15$  psi. Repeat at Pb = 50 & 100 differential pressure must remain at  $75 \pm 15$  psi.

- 7.2 Set PLA = max. Increase Pb until Wf = 25000 PPH. Adjust sensor for inline regulator until differential across total flow T.V. is 40 psi.

8.0 Pb SERVO CALIBRATION

NOTE: Refer to Build-Up Sheet for Dim K L-7208-12. If Dim K is Plus (+) add this amount to the below Pb pressures.

- 8.1 Set PLA = Idle, increase Pb =  $15 \pm K$ , bleeds closed. Adjust peak throttle valve position adjustment until cam follower is in bottom of the detent on the Pb Cam.

Note: Bottom of detent is determined by change of motion on dial indicator. Bottom of detent is located at point where indicator reverses direction no more than ( $\pm 0.001$ ).

- 8.2 Increase Pb to  $215 \pm K$ . Shim C.B.A. pushrod until cam follower is in bottom of high Pb detent.

- 8.3 Repeat 8.1 and 8.2 until detents are set.

- 8.4 Set PLA = Idle, bleeds open. Vary Pb from 5 to 215. Locate low and high Pb detents. Difference between detents must be  $168 \pm 2$  psi. Adjust CBA pushrod ball follower until this difference is obtained.

HAMILTON STANDARD  
DIVISION OF UNITED AIRCRAFT CORPORATION  
WINDSOR LOCKS, CONNECTICUT, U. S. A.

SPEC. No. HS 1373B  
Page 8 of

CODE 73030

- 8.5 Set the bleeds in the closed position and determine that the Tt2 cam detents are still located at  $15 \pm K$  at  $215 \pm K$  psia.
- 8.6 Repeat items 8.1 thru 8.6 if required.
- 9.0 TEMPERATURE SERVO CALIBRATION
- 9.1 Set PB =  $15 \pm K$ , PLA = max, Tt2 =  $-65^\circ F$ , bleeds closed. Adjust position spring on the Tt2 input lever until the cam calibration follower just starts to come out of the detent ( $\pm .0001$ ).
- 9.2 Set PB =  $15 \pm K$ , PLA = max. Tt2 =  $+950^\circ F$ , bleeds closed. Adjust rate spring on the flapper until the cam calibration follower just starts to come out of the detent ( $\pm .0001$ ).
- 9.2.1 For calibration it is acceptable to simulate temperatures above  $250^\circ F$  per para. 1.2.4 of this specification.
- 9.3 Repeat items 9.1 and 9.2 until the detents are set.
- 10.0 TOTAL FLOW THROTTLE VALVE CALIBRATION
- 10.1 Set PB = 15, PLA = max. Tt2 =  $60^\circ F$ , bleeds closed. Record total flow T.V. displacement and total metered flow. Increase PB = 100. Record total flow T.V. Displacement and total metered flow T.V. rate is 90 PPH/.001.

## HAMILTON STANDARD

## DIVISION OF UNITED AIRCRAFT CORPORATION

WINDSOR LOCKS, CONNECTICUT, U. S. A.

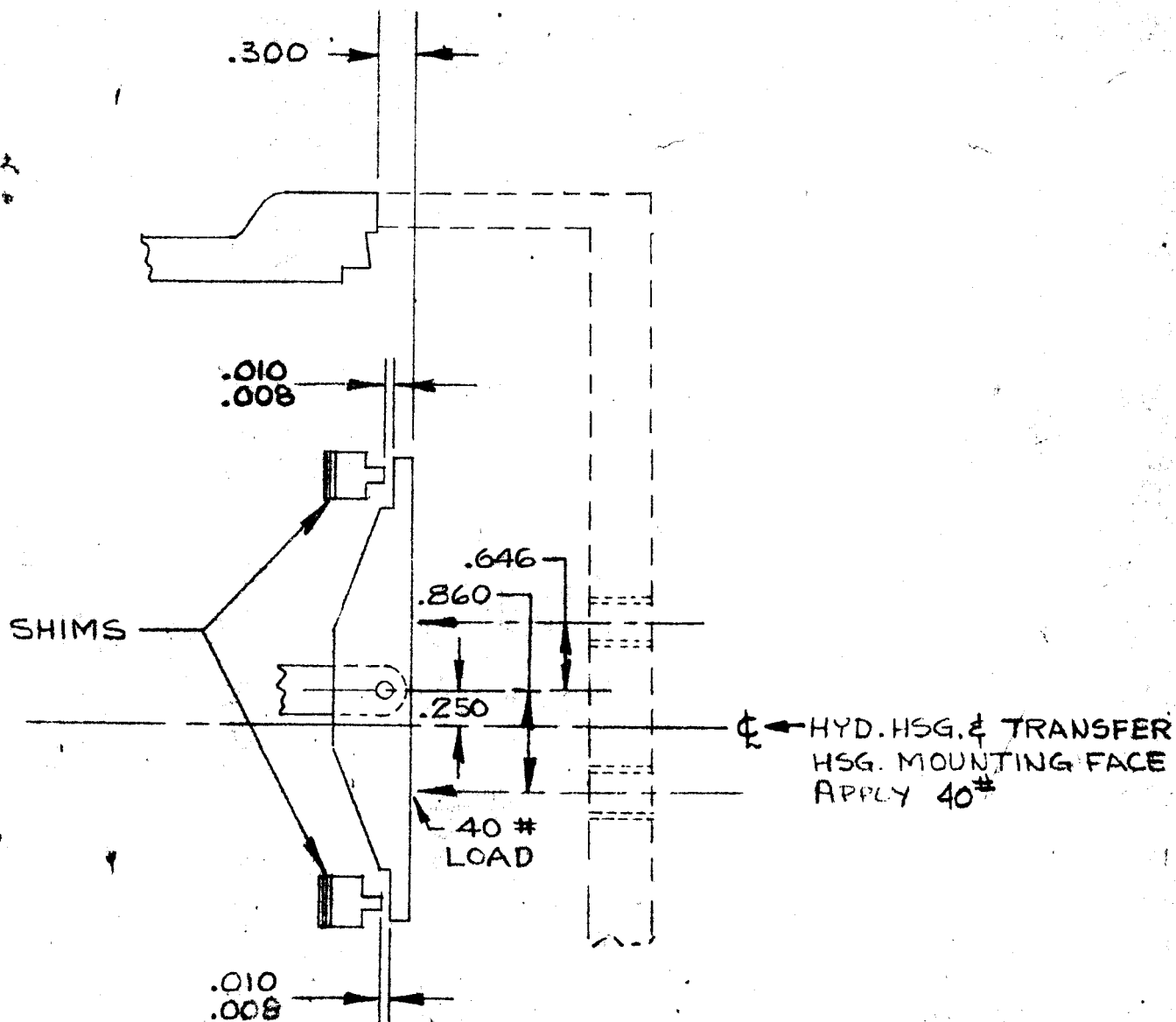
SPEC. No. HS 1373B

Page 9 of

CODE 73030

- 10.2 Bleeds closed, PLA = 0, Tt2 = +60°F, PB = 200. Recirculation flow must be 3000 PPH. Adjust minimum flow stop until this Wf is obtained.
- 10.3 Bleeds closed, Tt2 = +60°F. Run and plot Wf vs. PB for PLA at max. and idle for PB of 15, 30, 50, 75, 100, and 150. A straight line drawn thru 15 and 50 on the max. line and 100 and 150 on the min. line must intersect at -2 psia and -150 pph. The actual intersection will be defined by finite values of Wf and PB. (Wf and PB error).
- 10.4 Bleeds closed, Tt2 = +60°F, PB = 15, PLA = max. Adjust T.V. multiplying lever hinge until Wf error is reduced to -150 pph.
- 10.5 If data lines determined in 10.3 do not intersect at -2 psia it will be necessary to reshim the T.V. multiplying lever hinge. Approx. .006 shims will change intercept 1 psi. Adding shims will move intercept to right (plus).
- 10.5.1 Set PLA = Max, PB = 100, Tt2 = +65°F, bleeds closed. Record Wf. Increase Tt2 to +550°F and record Wf. Differential Wf between +65°F and +550°F must be 9000 ± 250 PPH. Adjust the Tt2 cam bias adjustment until this differential is obtained.
- 10.6 PLA = idle, PB = 100, Tt2 = +60°F, bleeds closed. Adjust power lever servo pilot valve position until Wf = 7000 PPH. At these conditions turn the power lever servo stop C.W. until Wf starts to increase. Then turn C.W. until Wf just stops decreasing.
- 10.7 Set PLA = Max., PB = 100, Tt2 = +60°F, bleeds closed. Adjust the power lever linkage bracket until Wf = 36000 PPH. At this time check stroke of the power lever servo. Stroke must be .900 ± .200 for full power lever movement.
- 10.8 Recheck 10.6 and 10.7, a slight trimming adjustment may be necessary.
- 11.0 POWER LEVER SERVO TRANSIENT (Optional to be run only if requested by H.S. Engineering.)
- 11.1 Shim inline regulator so full stroke of power lever servo is obtained in  $4.75 \pm .25$  sec. Check affect of pressure and flow level on this transient.
- 11.2 Set PLA = Idle, PB = 100, Tt2 = +60°F, bleeds closed. Move power lever to max flow. Rate change must be 14400 PPH/sec. Maximum.
- 12.0 ZONE 2 MANIFOLD TRANSFER
- 12.1 Set PLA = Idle, PB = 60, Tt2 = +60°F, bleeds closed. Increase PLA and determine actuation point of the Zone 2 manifold. The Zone 2 manifold must actuate at 16200-17200 PPH. Adjust the C.D.P. power spring to set the correct actuation point.

## L-7208-23 ZONE II TRANSFER



SHIM UNDER NOZZLES TO OBTAIN .080-.010 GAP



## HAMILTON STANDARD

DIVISION OF UNITED AIRCRAFT CORPORATION

WINDSOR LOCKS, CONNECTICUT, U. S. A.

SPEC. No. HS 1373B

CODE 73030

Page 10 of

- 12.2 Set PLA = Idle, PB = 15, Tt2 = +60°F, bleeds closed. Increase PB = 120, increase PLA and determine actuation point of the Zone 2 manifold. The Zone 2 manifold must actuate at 32750 - 34250 PPH.
- 12.3 Set PLA = max, PB = 120, Tt2 = + 60°F, bleeds closed. Decrease PLA and determine point at which the Zone 2 manifold closes. Zone 2 manifold must close at 31750 - 34250 PPH.

13.0 PEAK THROTTLE VALVE RATE

- 13.1 Set PLA = max, PB = 50, Tt2 = +60°F bleeds closed. Record Wf in Zone 1. Increase PB to 150 and record Wf in Zone 1. Difference in Wf between 50 and 150 PB must be 22500-23500 PPH. Adjust peak valve sensor until this difference is obtained.

FINAL CALIBRATION

Note: A Torque of 45-50 in-# shall be applied to the pump control output lever throughout final calib.

14.0 MAX RATIO CALIBRATION - BLEEDS CLOSED

- 14.1 Set PLA = Max, Tt2 = +60°F, bleeds closed. Record total metered Wf, peak Wf, T.V. Δ P and P.C. Δ P at the following P<sub>B</sub> pressures. (Note: Approach 15 psia in the increasing P<sub>B</sub> direction in all cases unless otherwise noted). PB = 15, 20, 30, 40, 50, 75, 100, 115, 150, 200, 220, 150, 100, 50 and 15 psia. See Appendix A-1 for limits. Hysteresis must be within 4% of increasing Wf. Record return to pump inlet flow at 15 and 220 psia.

15.0 MIN RATIO CALIBRATION - BLEEDS CLOSED

- \*15.1 Set PLA = idle, Tt2 = +60°F, bleeds closed. Record total metered Wf, T.V. Δ P, and P.C. Δ P at the following PB pressures; 15, 30, 50, 100, 150, 200, 220, 100, and 30 PSIA. See appendix A-2 for limits. Hysteresis must be within 4% of increasing Wf. See Note in Para. 14.1.

16.0 MAX RATIO CALIBRATION - BLEEDS OPEN

- \*16.1 Set PLA = max, Tt2 = +60°F, bleeds open. Record total metered Wf, Peak Wf, T.V. Δ P and P.C. Δ P at the PB pressures listed in 14.1. See appendix B-1. For Limits hysteresis must be within 5% of increasing Wf.

17.0 MIN RATIO CALIBRATION - BLEEDS OPEN

- \*17.1 Set PLA = Idle, Tt2 = 60°F, bleeds open. Record total metered Wf, T.V. Δ P, and P.C. Δ P at the PB pressures listed in 15.1. See appendix B-2. For limits hysteresis must be within 5% of increasing Wf.

18.0 POWER LEVER SEQUENCE AND TRANSIENT

HSP-755.1A 5/61

## HAMILTON STANDARD

SPEC. NO. HS 1373B

DIVISION OF UNITED AIRCRAFT CORPORATION

CODE IDENT NO. 73030

WINDSOR LOCKS, CONNECTICUT, U. S. A.

PAGE 11 OF

- \*18.1 Set PLA = max, Tt2 = +60°F, PB = 15, bleeds closed. Apply 150 psig to the speed signal valve. Decrease PLA to 0° then slowly increase PLA. At 66-68° the recirculation valve must close and the zone I primary manifold S.O.V. must open. Increase PLA to 120°. Decrease pressure to speed signal valve to zero. Control must remain in the on position. Increase pressure to the speed signal valve to 150 PSIG, then slowly decrease PLA. Record PLA at which S.O.V. closes.

Note 18.2 and 18.3 to be run only if requested by H.S. Engineering.

- 18.2 Set PLA = Idle, PB = 100, Tt2 = +60°F, bleeds closed. Connect Sanborne recording equipment to the total flow element. Increase the power lever to max position. Rate of change of metered Wf must be 14400 PPH/sec. maximum. Repeat in the decreasing power lever direction.
- 18.3 Repeat item 18.2 at PB of 15, 50 and 150 psia. Wf rate change must not exceed 2120 PPH/sec at 15 psia, 7200 PPH/sec at 50 psia, and 21200 PPH/sec. at 150 psia.

19.0 TEMPERATURE (Tt2) SENSING CALIBRATION - (See Appendix C-1 for Limits)

- \*19.1 Set PLA = max, Tt2 = -65°F, bleeds closed. Record total metered Wf at the following PB pressures: PB = 20, 30, 40, 50, 100, 150. See Note Para. 14.1.
- \*19.2 Repeat item 19.1 at temperatures (Tt2) of 0°F, +150°F, +550°F, +150°F, 0°F. Note: Temps. below 250°F to be actual, above can be simulated.
- \*19.3 Repeat item 19.1 at +550°F with bleeds open.

20.0 MANIFOLD TRANSFER SYSTEM CALIBRATION

- 20.1 In the following calibration record total metered Wf at the manifold transfer points.
- \*20.2 Set PLA = idle, PB = 30, Tt2 = +60°F bleeds closed. Increase PLA to max, record point listed in item 20.1.
- \*20.3 Repeat item 20.2 at PB of 60, 80, 100, 125, 150 and 190 psia. Run in decreasing power lever direction at 150 and 60 PB. See appendix D-1 for limits.
- \*20.4 Set bleeds in open position and repeat item 20.2 and 20.3. See appendix D-2 for limits.

21.0 MINIMUM OPERATING PRESSURE

- \*21.1 Set PLA = idle, PB = 15, Tt2 = +60°F, bleeds closed. Metered Wf must be 3150-3450 PPH. Record control inlet pressure and control body pressure. Control inlet pressure must be a minimum of 135 psi above control body pressure.

HSF-755.1A 5/61

HAMILTON STANDARD  
DIVISION OF UNITED AIRCRAFT CORPORATION  
WINDSOR LOCKS, CONNECTICUT, U. S. A.

SPEC. NO. HS

CODE IDENT NO.

PAGE 12 OF

22.0 SHUT-OFF VALVE LEAKAGE

- \*22.1 Set PLA = 0°, Tt2 = +60°F, PB = 15, bleeds closed. Remove zone I and zone II outlet lines. Leakage in Zone I and Zone II must not exceed 10 dpm in either line. Re-connect outlet lines and shut down main and boost pumps.
- \*22.2 Set PLA = 0°, Tt2 = +60°F, PB = 15. Start Boost Pump only and maintain Boost Pressure at 50 psig. Remove Zone I and Zone II outlet lines. Leakage must not exceed 10 dpm in either line. Re-connect outlet lines. Turn on main pumps.

\*23.0 RECIRCULATION VALVE LEAKAGE

- \*23.1 Set PLA = max, Tt2 = 60°F, PB = 15, bleeds closed. Remove the recirculation line. Leakage in the recirculation line must not exceed 20 cc/minute.

24.0 HOT TEST REQUIREMENTS

- \*24.1 The following items shall be run at room temperature ambient conditions and fuel temperatures of 150° - 175°F.
- \*24.2 Run items 14.1, 15.1, 20.2, and 20.3. Note: No external leakage is allowable.
- \*24.3 The following items shall be run under room temperature ambient conditions and fuel temperatures of 350° - 375°F.
- \*24.4 Run items 14.1, 15.1, 20.2 and 20.3. Note: No external leakage is allowable.
- 24.5 H.S. Engineering will determine acceptability of controls meeting Hot test requirements upon presentation of data.

25.0 PRESERVATION AND STORAGE

- 25.1 At conclusion of bench calibration, drain the calibrating fluid from the control and prepare the control for shipment in accordance with H.S.Spec 380.

**HAMILTON STANDARD**  
**DIVISION OF UNITED AIRCRAFT CORPORATION**  
**WINDSOR LOCKS, CONNECTICUT, U. S. A.**

SPEC. NO. HS 1373B

CODE IDENT NO. 73030

PAGE 13 OF

APPENDIX A-1

<u>PB</u>	<u>Conditions</u>	<u>Total Wf Limits</u>	<u>Peak Wf Limits</u>
15	Tt2 = 60°F	5650-6250	3325-3675
20		7400-8200	4375-4825
30	Bleeds closed	10900-12100	6550-7250
40		14500-16000	8750-9650
50	PLA = Max.	18150-19950	10925-12075
75		26500-28500	16400-18100
100		34900-36900	22000-24000
115		42400-44000	25450-27450
150		52400-54400	33500-35500
200		59000-61000	41500-43500
220		59000-61000	41500-43500

APPENDIX A-2

<u>PB</u>	<u>Conditions</u>	<u>Total Wf Limits</u>
15	Tt2 = 60°F	2850-3150
30		2850-3150
50	Bleeds closed	3275-3625
100		6550-7250
150	PLA = Idle	9875-10875
200		13100-14500
220		14450-15950

APPENDIX B-1

<u>PB</u>	<u>Conditions</u>	<u>Total Wf Limits</u>	<u>Peak Wf Limits</u>
15	Tt2 = 60°F	6650-7500	3800-4300
20		8750-9850	5125-5775
30	Bleeds open	12875-14525	7700-8700
40		17050-19250	10250-11550
50	PLA = Max.	21400-23800	12825-14475
75		31500-33900	19300-21700
100		41500-43900	26100-28500
115		50400-52800	30200-32600
150		58800-61200	39800-42200
200		58800-61200	41300-43700
220		58800-61200	41300-43700

APPENDIX B-2

<u>PB</u>	<u>Conditions</u>	<u>Total Wf Limits</u>
15	Tt2 = 60°F	2825-3175
30		2825-3175
50	Bleeds open	3850-4350
100		7700-8700
150	PLA = Idle	11550-13050
200		15450-17450
220		17025-19175

HSF-755.1A 5/61

**HAMILTON STANDARD**SPEC. NO. HS 1373 B

DIVISION OF UNITED AIRCRAFT CORPORATION

CODE IDENT NO. 73030

WINDSOR LOCKS, CONNECTICUT, U. S. A.

PAGE 14 OF       APPENDIX C-1Temperature Sensing Calibration

Tt2 = -65°F B.C.

Tt2 = 0°F. B.C.

<u>PB</u>	<u>Total Wf Limits</u>
20	8650-9750
30	12925-14575
40	17000-19200
50	21100-23500
100	42200-44600
150	58800-61200

<u>PB</u>	<u>Total Wf Limits</u>
20	7950-8950
30	11750-13250
40	15600-17600
50	19500-21900
100	38300-40700
150	57100-59500

Tt2 = +150°F. B.C.

Tt2 = +550°F. B.C.

<u>PB</u>	<u>Total Wf Limits</u>
20	7625-8575
30	11425-12875
40	15175-17125
50	18300-20700
100	35750-38150
150	53600-56000

<u>PB</u>	<u>Total Wf Limits</u>
20	6950-7850
30	10100-11300
40	13350-15050
50	16500-18600
100	33350-35750
150	50300-52700

Tt2 = +550°F. B.O.

Note: Hysteresis Wf must be  
within 5% of Wf in the  
increasing Tt2 direction

<u>PB</u>	<u>Total Wf Limits</u>
20	8100-9300
30	11800-13600
40	15575-17825
50	19350-22150
100	39500-42300
150	58600-61400

APPENDIX D-1

<u>PB</u>	<u>Transfer Wf</u>
30	7925-8775
60	15875-17525
80	21200-23200
100	26800-28800
125	33800-35800
150	40700-42700
190	43000-45000

Note: Hysteresis Wf must be  
within 2000 FPH of  
increasing Wf.

HSF-753.1A 5/61

**HAMILTON STANDARD**  
**DIVISION OF UNITED AIRCRAFT CORPORATION**  
**WINDSOR LOCKS, CONNECTICUT, U. S. A.**

SPEC. NO. HS 1373 B

CODE IDENT NO. 73030

PAGE 15 OF       APPENDIX D-2

<u>FB</u>	<u>Transfer Wf</u>
30	9300-10500
60	18700-21100
80	25300-27700
100	31900-34300
125	40200-42600
150	42800-45200
190	42800-45200

APPENDIX E-1

<u>Wf Zone 1</u>	<u>ΔP Injection Manifold (Psi)</u>
3000	90-110
6000	140-165
10000	190-230
20000	295-345
30000	380-440
40000	460-520

<u>Wf Zone 2</u>	<u>ΔP Injection Manifold (Psi)</u>
2000	115-145
3000	135-165
5000	205-245
10000	315-365
150000	410-470

## HAMILTON STANDARD

SPEC. NO. HS 1373B

DIVISION OF UNITED AIRCRAFT CORPORATION

CODE IDENT NO. 73030

WINDSOR LOCKS, CONNECTICUT, U. S. A.

PAGE 16 OF

APPENDIX FJFC-51 SHIMMING INSTRUCTIONS

Note: These shimming instructions are to be used for initial buildup. Final shim thickness and setting dimensions may be varied to meet the final flow calibration.

1. Power Lever Indexing (REF. L-7208-24; Et-1)

Determine Max. A/B stop, decrease power lever  $53^{\circ}$  from this point. Insert index pin through the hole in the protractor, index ring, and stop plate.

Protractor must read  $67^{\circ}$  at this point. If necessary, slip the protractor face until it reads  $67^{\circ}$ . Lock protractor and stop plate in place.

2. Throttle Valve Roller Linkage (REF. L-7208-10)

2.1 Shim Bracket 560169 on peak valve piston such that "bellorank" lever 558961 has a 1:1 lever ratio.

2.2 Obtain dim. A (see Fig. 2) prior to installation of peak valve.

2.3 Shim thickness =  $A - B - 2.00$

3. Throttle Valve Multiplying Lever Pivot (REF. L-7208-10)

3.1 Shim the multiplying lever pivot bracket 558958 such that the distance from the centerline of the pivot to the centerline of the rollers 568339 is 1.335 when the peak valve is at 215 psia  $\pm$  K.

3.2 Set the multiplying lever at an angle of  $30^{\circ}$  by utilizing fixture 560000ET39 (See Fig. 1). Position the peak valve to 215 psia  $\pm$  K. Zero out dial indicator. Install gage which locates rollers in respect to the centerline of the multiplying lever pivot. Adjust the peak valve position until the rollers are properly located. Determine amount and direction peak valve was moved. If adjusting screw was turned CCW (lower CDP) subtract this amount of shims from the multiplying lever pivot bracket. Add if C.W.

HSP-755.1A 5/61

**HAMILTON STANDARD**  
**DIVISION OF UNITED AIRCRAFT CORPORATION**  
**WINDSOR LOCKS, CONNECTICUT, U. S. A.**

SPEC. NO. HS 1373B

CODE IDENT NO. 73030

PAGE 17 OF

4. Throttle Valve Roller Guide (Ref. L-7208-10)

- 4.1 Shim position of throttle valve roller guide 558954 such that distance from bottom of roller carriage track to top of metering window in the throttle valve is  $3.853 \pm .002$  (see Fig. 3).

5. Throttle Valve Position Adjustment (Ref. L-7208-10)

- 5.1 Assemble throttle valve less return springs in control. Position the throttle valve so that it is .010 from bottoming (minimum flow position).
- 5.2 With throttle valve located as in 5.1 limit the travel of the position adjustment rod 558963 by shimming under spacer 560213 with shims 513029 such that  $A = B$ . (See Fig. 9)

6. Power Lever Servo Output Lever (Ref. L-7208-10)

- 6.1 Install bracket 558966 on Servo Housing.
- 6.2 Obtain Dim. B, and C as shown on Fig. 4.
- 6.3 Shim between the Servo Housing and bracket 558966. Shim thickness =  $1.080 - (B+C)$ .

7. Peak Throttle Valve  $T_2$  Cam (Ref. L-7208-12)

- 7.1 Determine the height to the centerline of the calibration cam follower A and to the centerline of control cam follower B from the parting line within .0005. (See Fig. 6)

- 7.2 Calculate Dim. K (to be used in control calibration)

$$\text{Dim. K} = \text{Calib. Cam Follower } H_t - \text{Control Cam Follower } H_t / .00615$$

Note: If Dim. K is minus, Dim. K must be subtracted from  $P_b$  settings specified in the control calibration.

- 7.3 Measure the following as shown on Fig. 6

C: Height of upper metering window edge in sleeve (558851) from parting line

D: Metering edge of piston (558849) to upper end of piston



MSF-755 1A 5/61

**HAMILTON STANDARD**  
**DIVISION OF UNITED AIRCRAFT CORPORATION**  
**WINDSOR LOCKS, CONNECTICUT, U. S. A.**

SPEC. NO. HS 1373B

CODE IDENT NO. 73030

PAGE 18 OF

(cont'd)

- E: From shim shoulder to spherical radius on guide 558853.
- F: From centerline of 15 psia detent on the cam 558860 to the shim shoulder on the cam.
- 7.4 Shim thickness =  $B - C + .092 - D - E - F$ .
- 7.5 Insert the cam shaft assembly in an arbor press in a vertical position. Apply a 30 lb. load to take the slop out of the pins. Measure the total shim thickness with a feeler gauge as shown in Fig. 6.
- 7.6 Install actual shim thickness between the 3-D cam and the cam shaft guide (558859).
- 7.7 Subtract the actual shim thickness from the total shim thickness and install these shims between the 3-D cam and the cam shaft collar (558857).
8. C.D.P. Sensor and Output Lever (Ref. L-7208-11)
- 8.1 Assemble the 560195 lever assembly and the 560194 housing. Using fixture 560000ET-33 locate the C.D.P. lever in the horizontal position and measure dimensions A and B as shown in Fig. 5.
- 8.2 Assemble the 560195 lever assembly into the servo housing. Hold the lever in the horizontal position as determined in 8.1 Shim the 558901 nozzles to give a .005 gap between each nozzle and the lever.
- 8.3 Assemble the motor bellows and adjust the screw so that the dimension from the bottom of pin 553137 to the bellows flange is  $B = .010 + \text{gap between bellows flange and housing 560194}$ .
- 8.4 Assemble evacuated bellows so that the dimension from the bottom of pin 553137 to bellows header is  $A - B = .045$ .
9. Temperature <sup>T</sup> 2 Washout Link (Ref. L-7208-14)
- 9.1 Obtain the dimension A from the  $T_2$  mounting face to the centerline of pin 69725-3C36 in bracket 560013. (See Fig. 8).

## DIVISION OF UNITED AIRCRAFT CORPORATION CODE IDENT NO. 73030

WINDSOR LOCKS, CONNECTICUT, U. S. A. PAGE 19 OF

AS 13138

- 9.2 With the power lever cam at its maximum radius obtain Dimension B  $T_2$  housing mounting surface to the centerline of pin 69538A9-6 in lever 560024.
- 9.3 Shim between bracket 560013 and bracket 560028 with shims 560284.
- 9.4 Shim thickness = A - B.
10. Compressor Bleed Shift Linkage (L-7208-13)
- 10.1 With the C.D.P. lever in its horizontal position and multiplying lever 560141 parallel to it, determine dimensions (A), (B), (C), and (D) as shown on Figure 7. Shim under support bracket 560158 with shims 560157.
- 10.2 Shim thickness = C - (A + B) - (D + E)
11. Pressure Regulating Valve Sensor - Peak and Inline (Ref. L-7208-116)
- 11.1 With the flapper system assembled outside the sensor housing.
- Determine dimensions A, B, and C with the flapper closed as shown in Fig. 11.
- 11.2 Shim under pin-ball 558869 with shims 515298.
- 11.3 Shim thickness  $A - (B + C) + .015$ .
12. Manifold Transfer System (L-7208-23)
- 12.1 Install 560000 Et-23 across hydraulic housing with 70 lb. force directed to the balance bar, locating the force balance bar (560112) in a horizontal position. With the balance bar in a horizontal position shim both nozzles to a .008 - .010 gap. See Fig. 10.
- 12.2 Install 560000 Et-24 across the hydraulic housing. Maintain the force balance bar (5600112) in a horizontal position by installing .008 - .010 shim stock between nozzles and the force balance bar.
- 12.3 Utilizing 560000ET-24 locate the centerline of the C.D.P. rollers .006 $\pm$ .002 from the centerline of pivot pin 69522-8-44 with the peak valve located at 15 psia  $\pm$  K. With the rollers held in this position shim under bracket 560082 with shims 560098 until distance from the centerline of pin 69725-3G-14 on CDP rollers is .205 $\pm$ .005 above the roller contact surface on the force balance bar.

- 12.4 Utilizing 560000ET-24 locate the centerline of the T.V. rollers .358<sup>±</sup>.002 from the centerline of pivot pin 69522-8-44 with the throttle valve set for a .014 window opening. See Fig. 22. With the rollers held in this position shim under bracket 560093 with shims 560099 until distance from centerline of pin 69522-8-44 on the throttle valve rollers is .208<sup>±</sup>.005 above the roller contact surface on the force balance bar.
- 12.5 Shim under bracket 560088 with shims 560097 so links 560087 and 560013 will not dis-engage under extreme travel conditions. (See Fig. 12)
- 12.6 Assemble transfer housing less power springs, adjusting screws and transfer valve. Install this assembly on fixture 560000 ET-31. Adjust position of lever 560069 and 560070 until it is parallel to the transfer housing mounting face. Obtain Dimension A. (See Fig. 19)
- 12.6.1 With transfer linkage assembled in hydraulic housing obtain the Dimension "B" from the top of the rollers to the hydraulic housing mounting face. (Fig. 11) Shim under bracket 560064 with shims 560096. Shim thickness = B - A.
13. Zone I Shut-Off Valve and Recirculation Valve
- 13.1 Obtain Dimension B on cap 558504 (See Fig. 18).
- 13.2 Assemble seat 539418, valve and sleeve assembly 560012 into the housing. Install chevrons and back-up rings and bottom chevrons with spacer 558905. With valve and seals held firmly against the shoulder obtain readings at 90° intervals on the retainer. The readings should not vary more than .004, if they do the assembly is not seated.
- 13.3 The average reading is dimension A.
- 13.4 Shim between spacer and back-up ring (See Fig. 18). Shim thickness = S-A-B-(.002 to .004).

14. Temperature Servo Piston Roller Position

14.1 Obtain dimension from the temperature servo piston cap mounting surface on the linkage housing to the centerline of peak throttle valve bore. (Dimension B. See Fig. 13).

14.2 Install the temperature servo piston and 560000 ET-21, and 560000ET-7. Position the servo piston until it is at  $-65^{\circ}\text{F}$  as indicated by the cam follower (560000 ET-7). With the piston held in this position obtain Dimension X.

14.3 Position rollers on the servo piston such that  $\text{Dim. A} = \text{B} - \text{X} = .745$

15. Temperature Servo

15.1 With levers 562050 and 562059 in line as shown on Fig. 15. Hold lever 560136 parallel to 562059 and shim under bracket 560138 until distance between 562059 and 560136 is  $.501 \pm .001$ .

15.2 With levers held as in 16.1 shim nozzles 560129 for a .003 gap on each nozzle.

15.3 Shim under bellows assembly 574153 with shim 562054. Shim thickness  $(\text{X} - \text{E}) + \left[ (\text{D} + \text{E}) - \text{A} \right] \pm .001$ . See Fig. 16 and 17.

15.4 Adjust stop screw 562055 until  $\text{Dim. C} - \text{F} = .300$ . See Fig. 17.

16. C.D.P. Sensor and Output Lever (Ref. L-7208-11)

16.1 Obtain dimension A. Centerline of C.D.P. bellows cavity to mounting surface for C.D.P. lever assembly. See Fig. 20.

16.2 Install approximately .050 shims 560187 in C.D.P. lever assembly.

16.3 Install the C.D.P. lever assembly in fixture 560000 ET-36. Load the lever on its pivots with screw item (1) and set the lever parallel to surface (3) with screw item (2).

16.4 Obtain dimension B. Centerline of pin (4) to mounting surface. See Fig. 21.

HSF-755.1A 5/61

**HAMILTON STANDARD**  
**DIVISION OF UNITED AIRCRAFT CORPORATION**  
**WINDSOR LOCKS, CONNECTICUT, U. S. A.**

SPEC. NO. HS 1373B

CODE IDENT NO. 73930

PAGE 22 OF

- 16.5 Shim lever with 560187 shims until  $A-B = 0$ .
17. Pump Control Piston (Ref. L-7208-112)
- 17.1 Shim under rack to position the pitch line on the centerline of the piston. See Fig. 23.
- 17.2 Obtain dim. A. O. D. of piston.
- 17.3 Position the lower piston rack until it is parallel to a referenced surface plate and obtain dim. B. using a 1150 dia. wire.
- 17.4 Shim under the rack with proper shims. Shim thickness =  $(\frac{A}{2} + .068) - B \pm .001$
18. Zone II Shut-Off Valve and Peak Regulation Valve.
- 18.1 Obtain dimension B on cap 558904. (See Fig. 24).
- 18.2 Assemble sleeve 560008, packing 574177, sleeve 560005 and spacer 574355 into the housing. With assembly bottomed in the housing obtain dimension A.
- 18.3 Shim for use at the bottom of the bore is part #574353. Shim thickness =  $A - B - (.002 \text{ to } .004)$ .
- 18.4 Assemble backup ring #69587-A-58, chevron #69588-58 and retainer #69586-A-58 on sleeve 560005. (See Fig. 25).
- 18.5 With the assembly held firmly against the shoulder obtain readings at 90° intervals on the retainer. The readings should not vary more than .004; if they do the assembly is not seated.
- 18.6 The average reading is dimension E.
- 18.7 Shim for use at this point is #569669. Shim thickness =  $E - (.002 \text{ to } .004)$ .
- 18.8 Assemble backup ring #69587-A-60, chevron #69588-60, retainer #69586-A-60 on sleeve 560005.
- 18.9 With the assembly held firmly against the shoulder obtain readings at 90° intervals on the retainer. The readings should not vary more than .004; if they do the assembly is not seated.

HSF-753.1A 5/61

**HAMILTON STANDARD**  
**DIVISION OF UNITED AIRCRAFT CORPORATION**  
**WINDSOR LOCKS, CONNECTICUT, U. S. A.**

**SPEC. NO. HS 1373B**

**CODE IDENT NO. 73030**

**PAGE 23 OF**

18.10 The average reading is dimension C.

18.11 Obtain dimension D as shown on Fig. 25.

18.12 Shim for use at this point is #569669. Shim thickness =  $C-D-(.002 \text{ to } .004)$ .

HSF-755.1A 5/61

## HAMILTON STANDARD

SPEC. NO. HS 1373B

DIVISION OF UNITED AIRCRAFT CORPORATION

CODE IDENT NO. 73030

WINDSOR LOCKS, CONNECTICUT, U. S. A.

PAGE 24 OF

APPENDIX G

<u>PART NAME</u>	<u>LENGTH OF STROKE</u>
1. Peak Throttle Valve	1.5 Min from bottomed position
2. Cam Shaft & Ends With Piston Ring	1.5 Min from top of bore
3. Pump Control	
a. Main Piston	1.4 Min from bottomed position
b. Intermediate Piston	.3 Min from top of housing
c. Pilot Valve	.4 Min from bottomed position
4. Throttle Operated Pilot Valve	
5. Transfer System	
a. Piston (Inl&H Hsg.)	.5 Min from bottomed position
b. Transfer Valve	.5 Min from bottomed position
6. PL Serve Pilot Valve	.5 Min from stop-pin
7. PL Serve Piston (with Piston Rings)	.9 Min from bottomed position
8. Time Delay Valve	.3 Min from bottomed position
9. Speed Signal Valve (Upper & Lower)	.4 Min from bottomed position
10. PRV Sensor and Peak Sensor	.25 Min from top of sleeve
11. Inline PRV	.4 Min from bottomed position
12. Main T.V. (Install in Hsg. with Cover)	Stop to Stop
13. Zone I SOV	.4 Min from window end of sleeve
14. Zone II Valves	
a. Recirculation	.4 Min from window end of sleeve
b. PRV & SOV	.4 Min from window end of sleeve
c. Ref. Valve	.4 Min from top of sleeve
15. Tt2 Piston (With Piston Rings)	From Piston Ring Chamfer to Bottomed Position

# L-7208-10 T.V. ROLLER LINKAGE

Spec.No.HS1373B

Page 25 of 5

## SHIMMING PROCEDURE

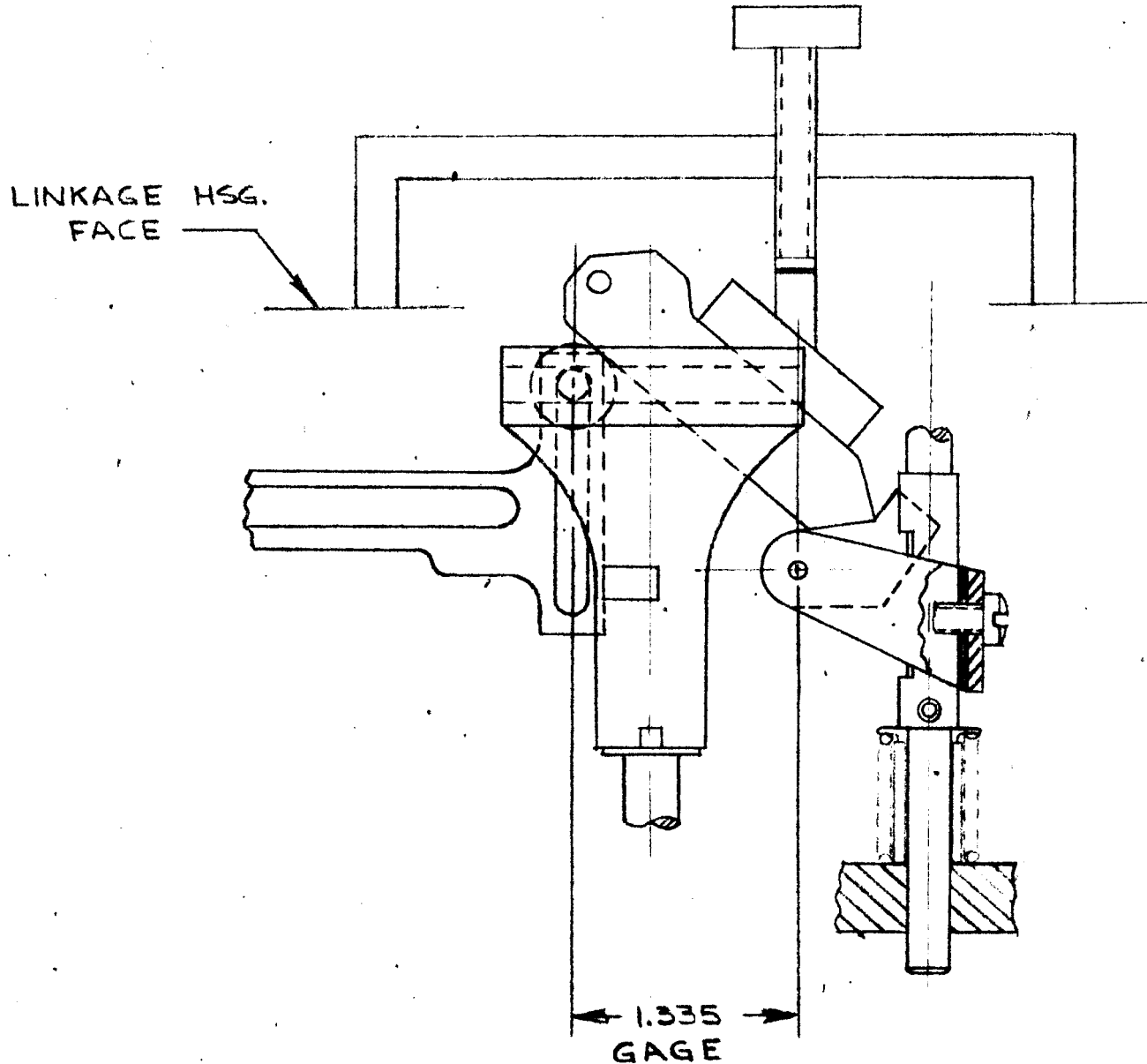


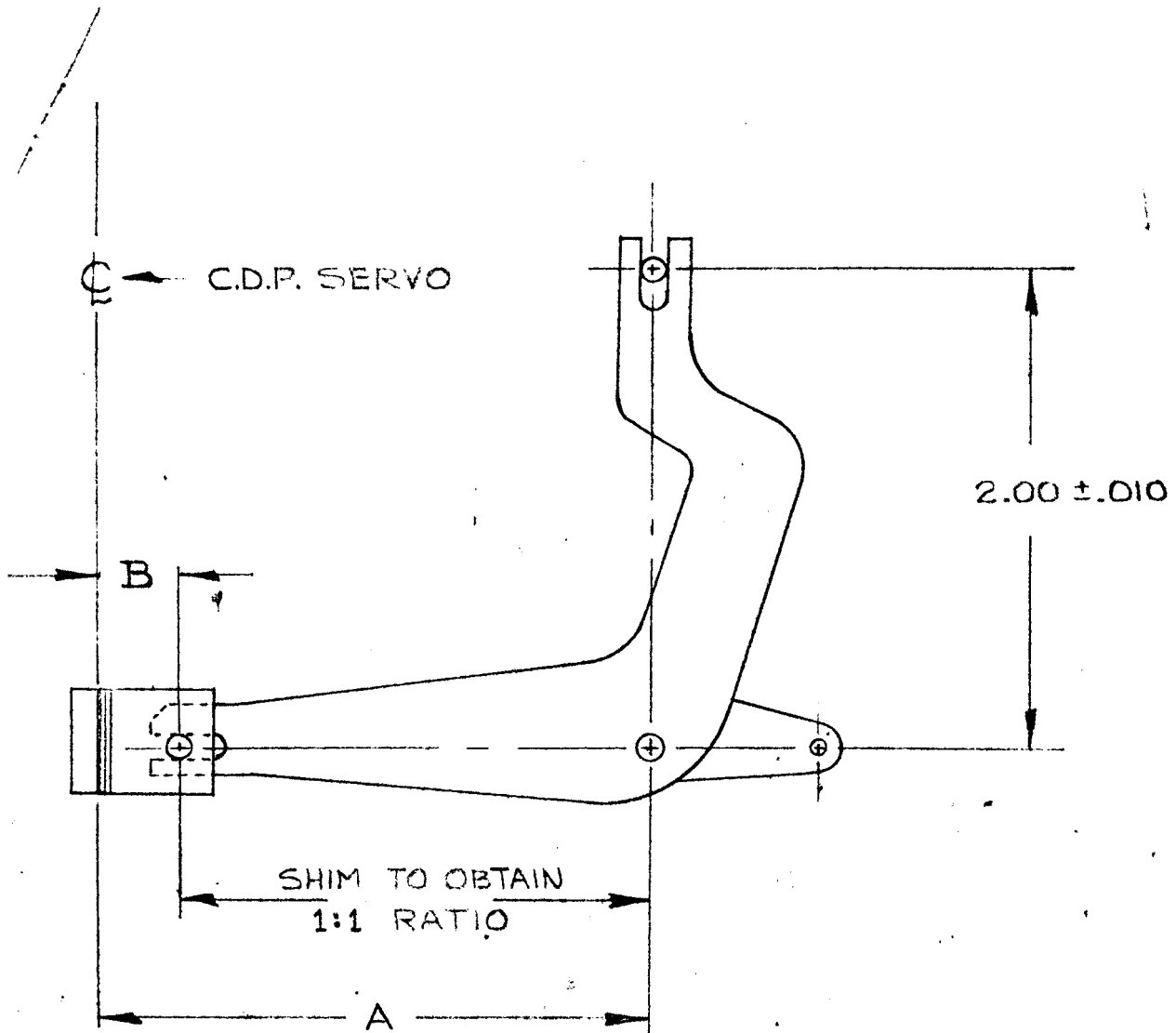
FIGURE 1



# L-7208-10 T.V. ROLLER LINKAGE

Spec. No. HS1373B  
Page 26 of 30

## SHIM TO OBTAIN 1:1 RATIO



$$\text{SHIM THICKNESS} = A - B - 2.00$$

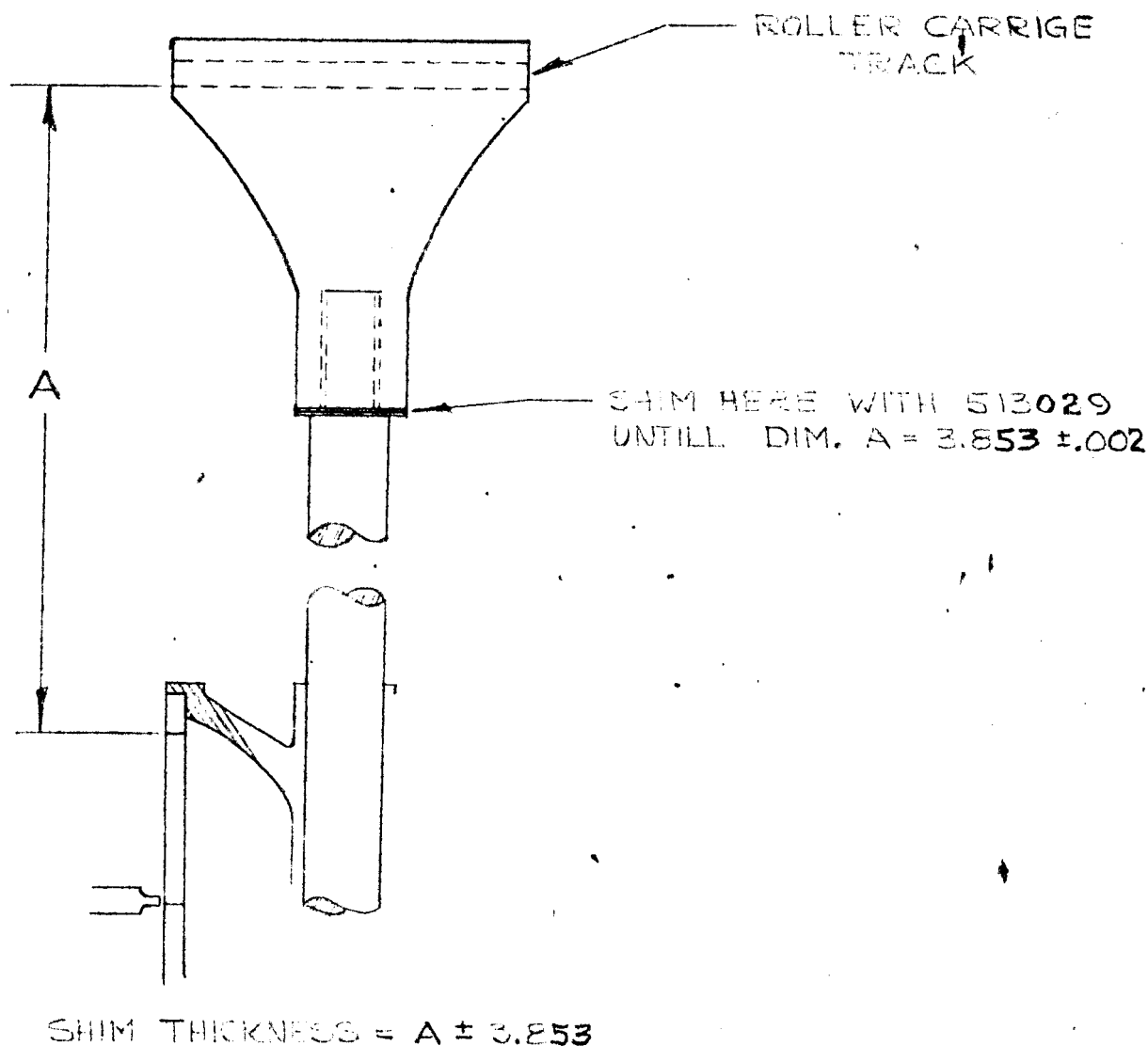
USE 2.00" RATHER THAN MEASURING ACTUAL  $2.00 \pm .010$  DIM., ERROR IN LEVER RATIO WILL BE INSIGNIFICANT, INSTEAD OF 1:1 RATIO WILL BE 1:1.01.

FIGURE 2

L-7208-10 T.V. LINKAGE

Spec. No. HS1373B

Page 27 of 30

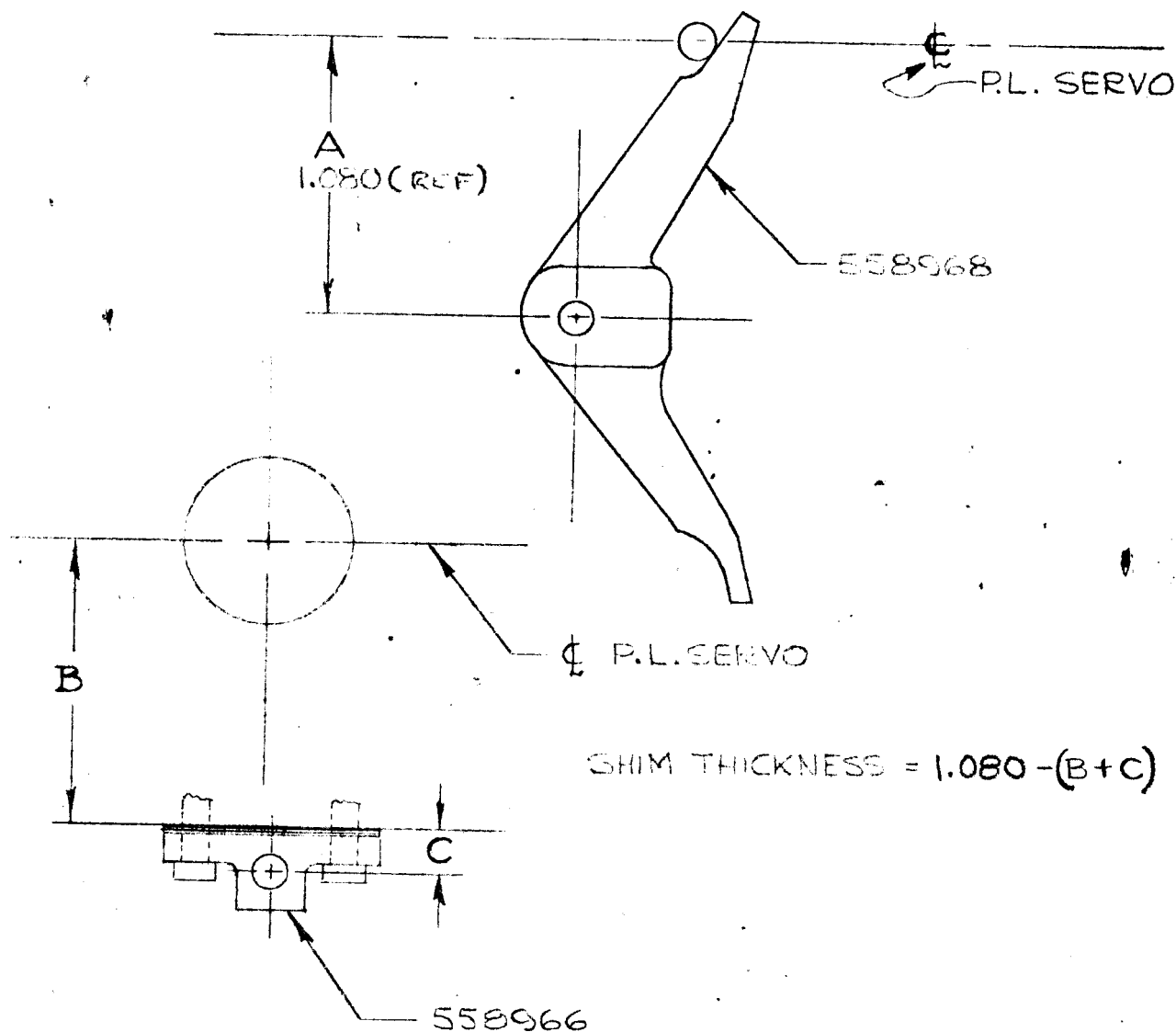


L-7208-10 T.V. ROLLER  
LINKAGE

Spec. No. HS1373B

Page 28 of 30

(SET CORRECT RATE BETWEEN  
P.L. SERVO & T.V. MULTIPLYING  
LEVER ANGULARITY.)



# L-7208-II C.D.P. SENSOR

Spec. No. HS1373B  
Page 29 of 30

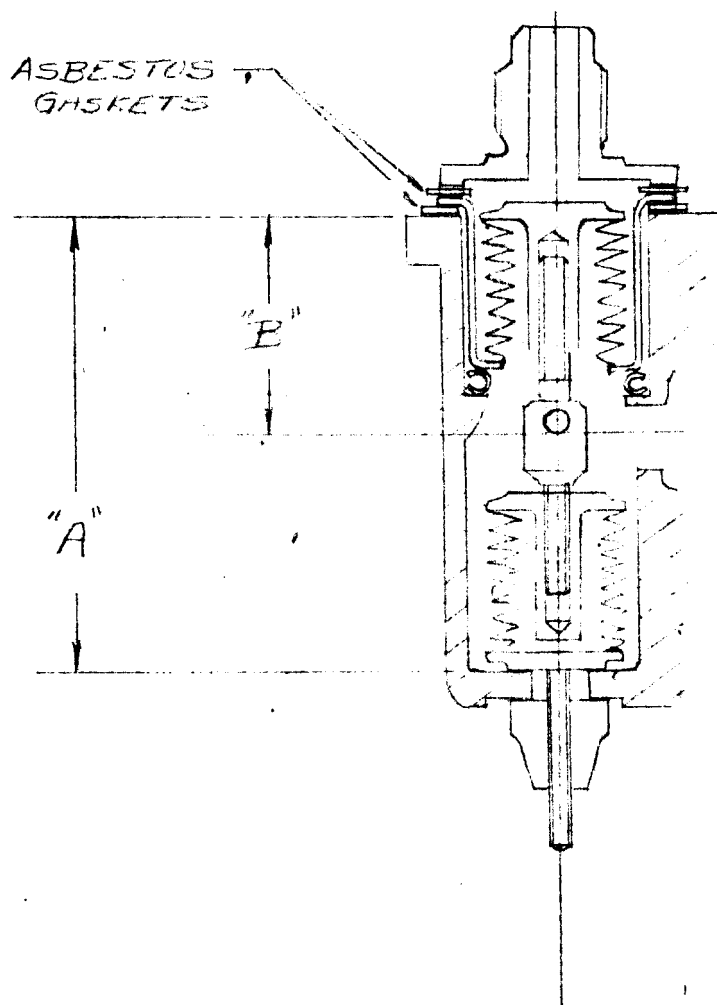
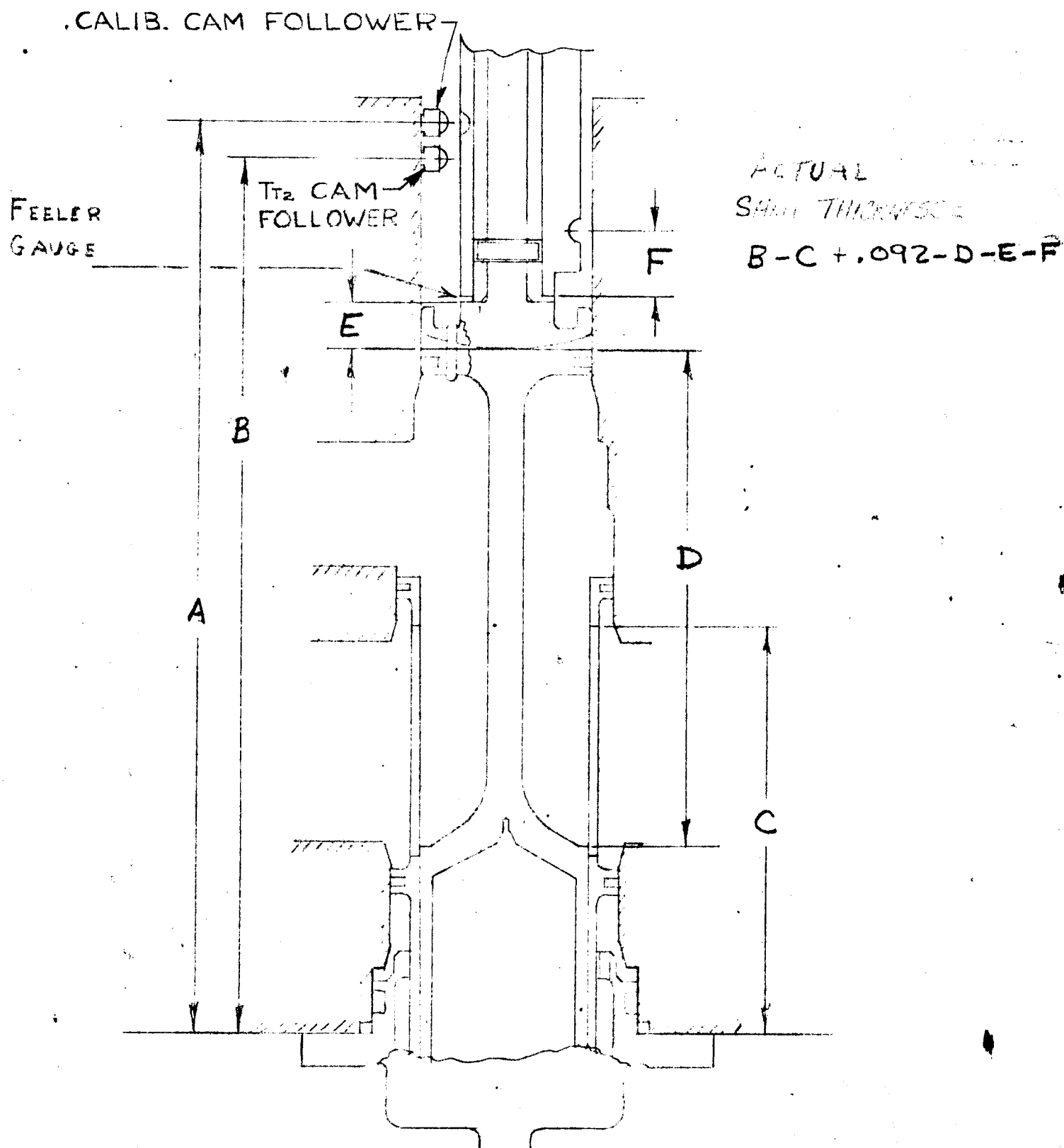


FIGURE 5

Spec. No. HS1373B

Page 30 of \_\_\_\_\_

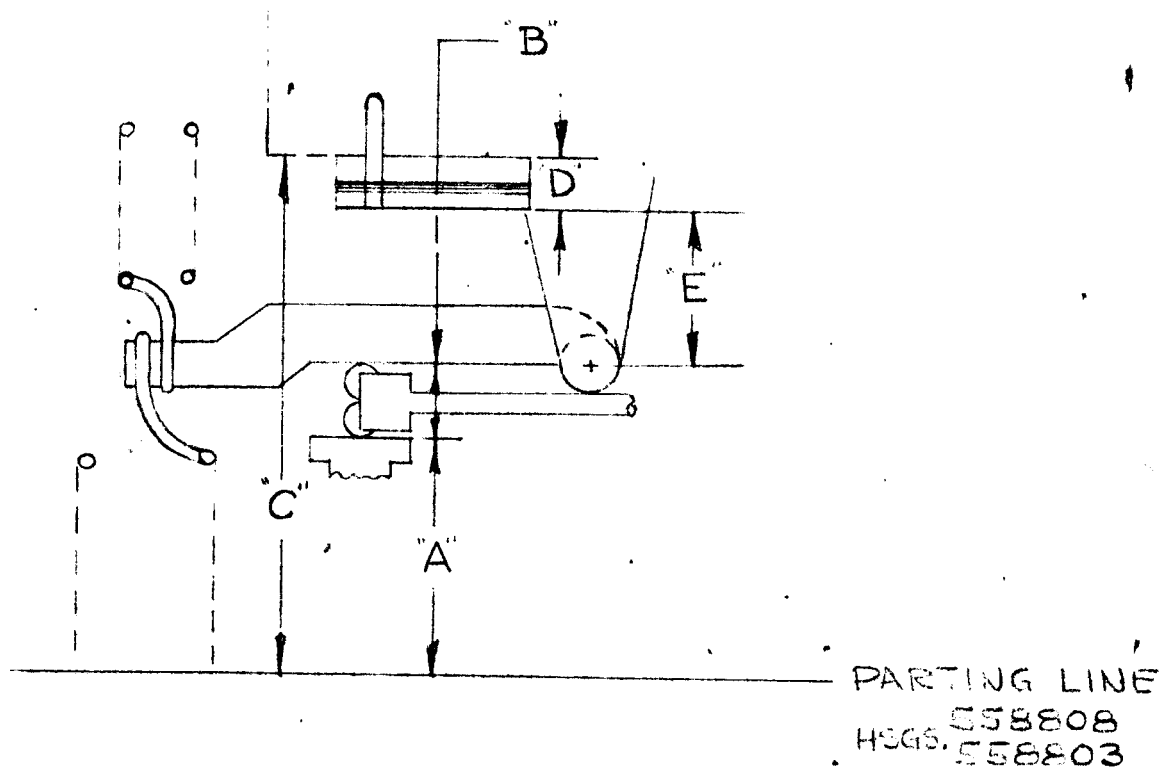


L-7208-13 C.B.A. LINKAGE

Spec. No. HS1373B

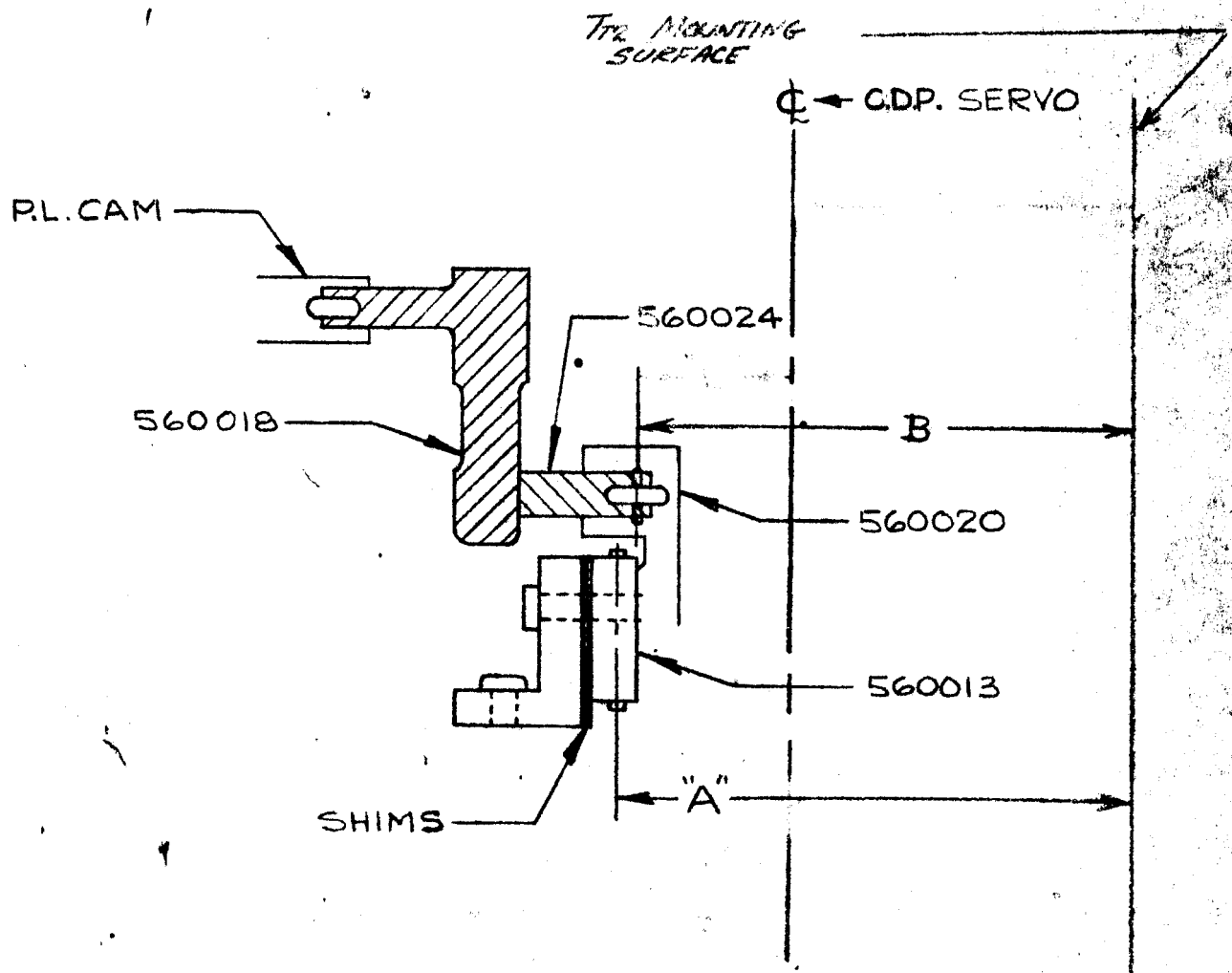
Page 31 of

MULTIPLYING LEVER & C.D.P. LEVER  
MUST BE PARALLEL



SHIM THICKNESS =  $C - (A + B) - (D + E)$

## L-7208-14 P.L. LINKAGE

Spec. No. HS1373B  
Page 32 of 52

POWER LEVER CAM TO BE AT MAX. RAD.  
WHEN MEASURING DIM. "B"

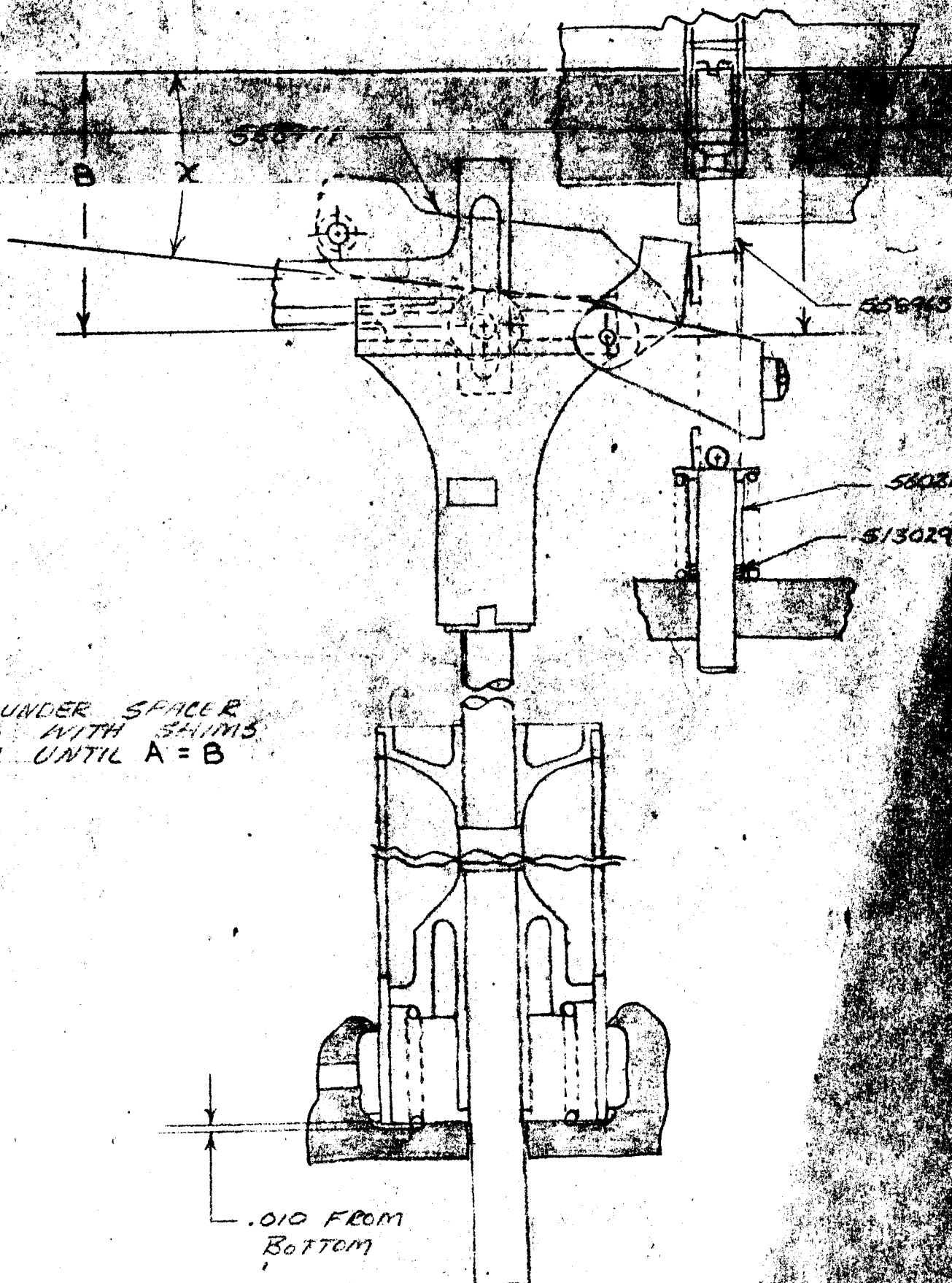
SHIM THICKNESS = A+B

FIGURE 8

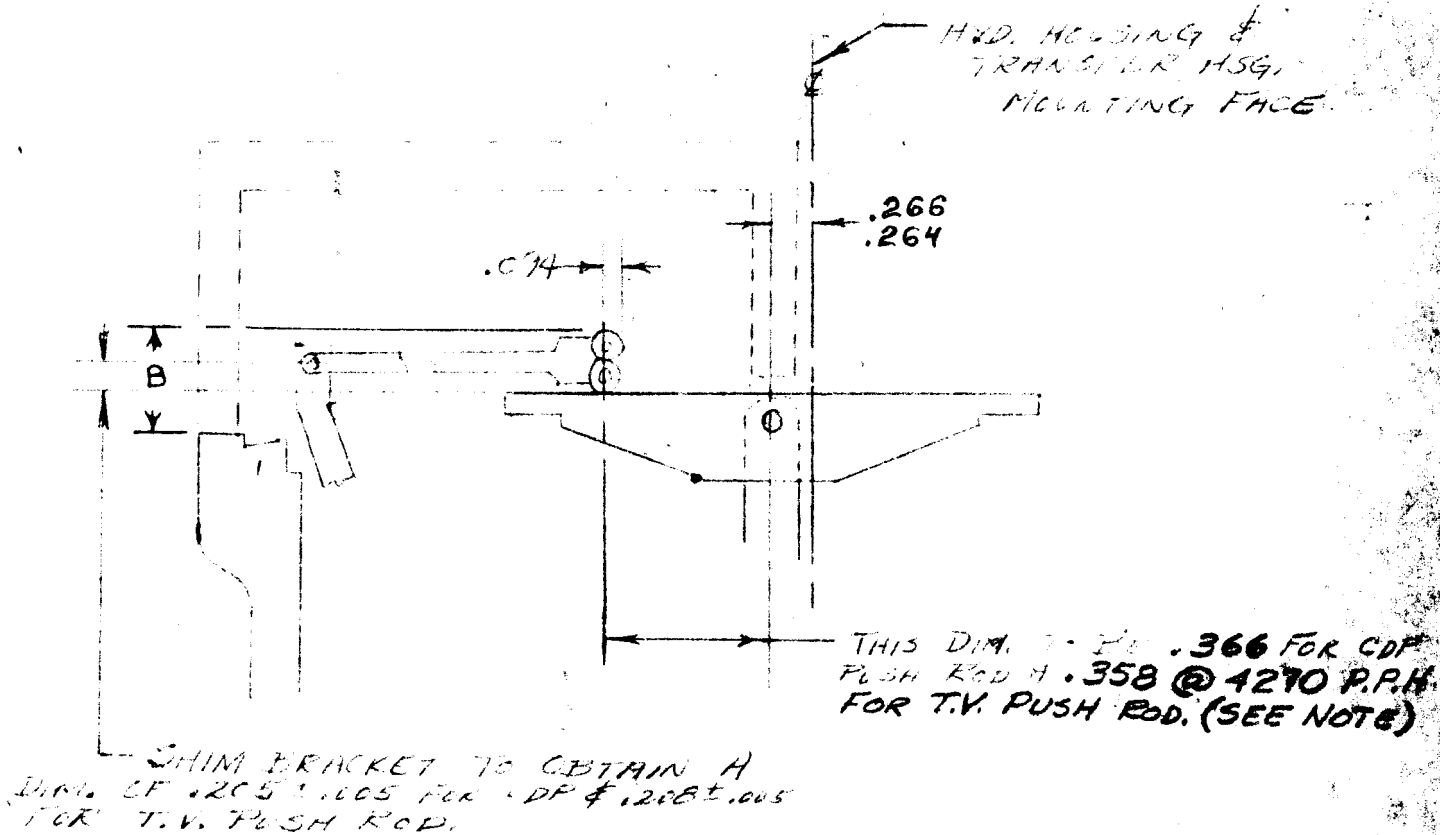
LINKAGE VALVE

LINKAGE

Spec No. HS1373B  
Page 33 of 38

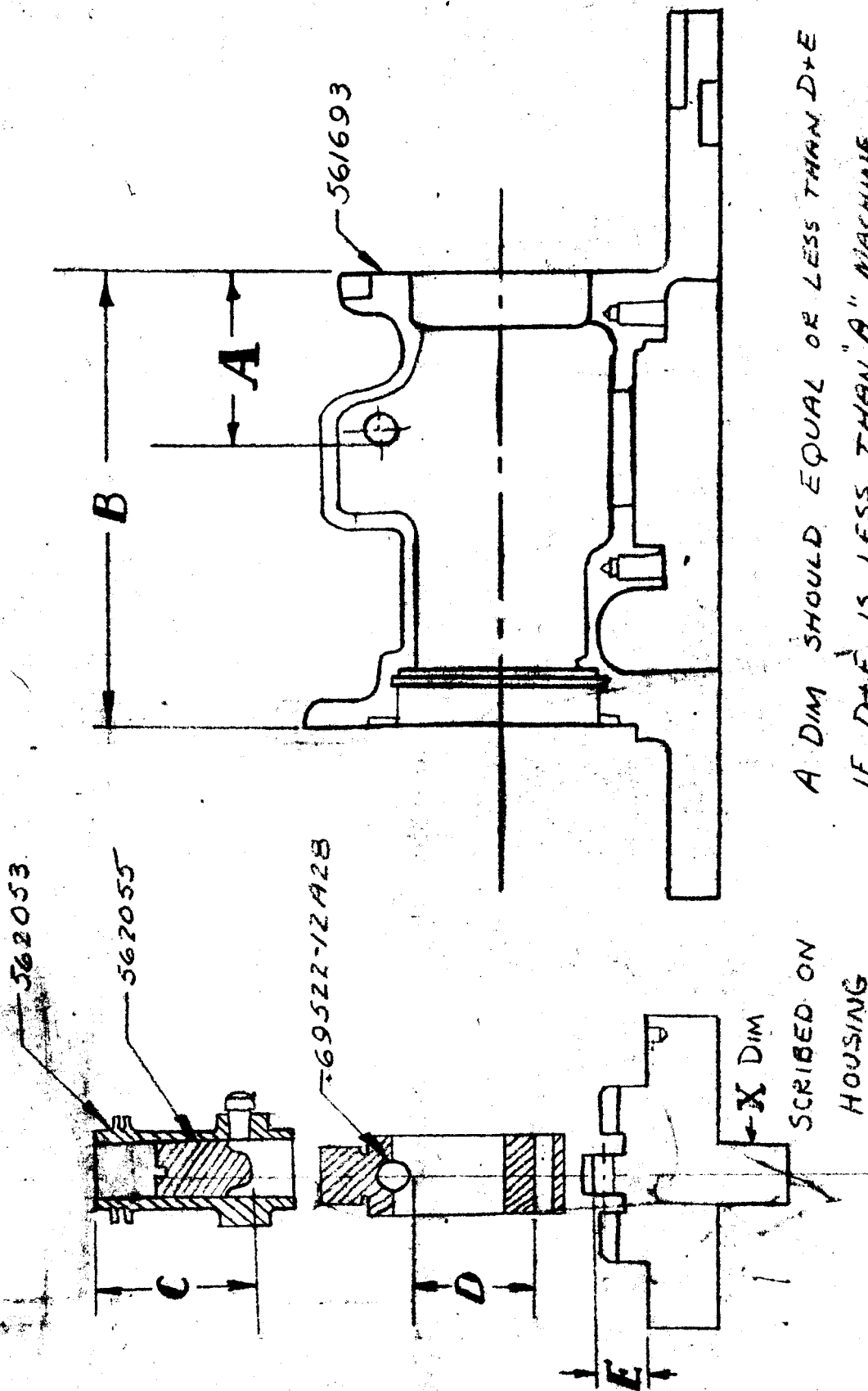




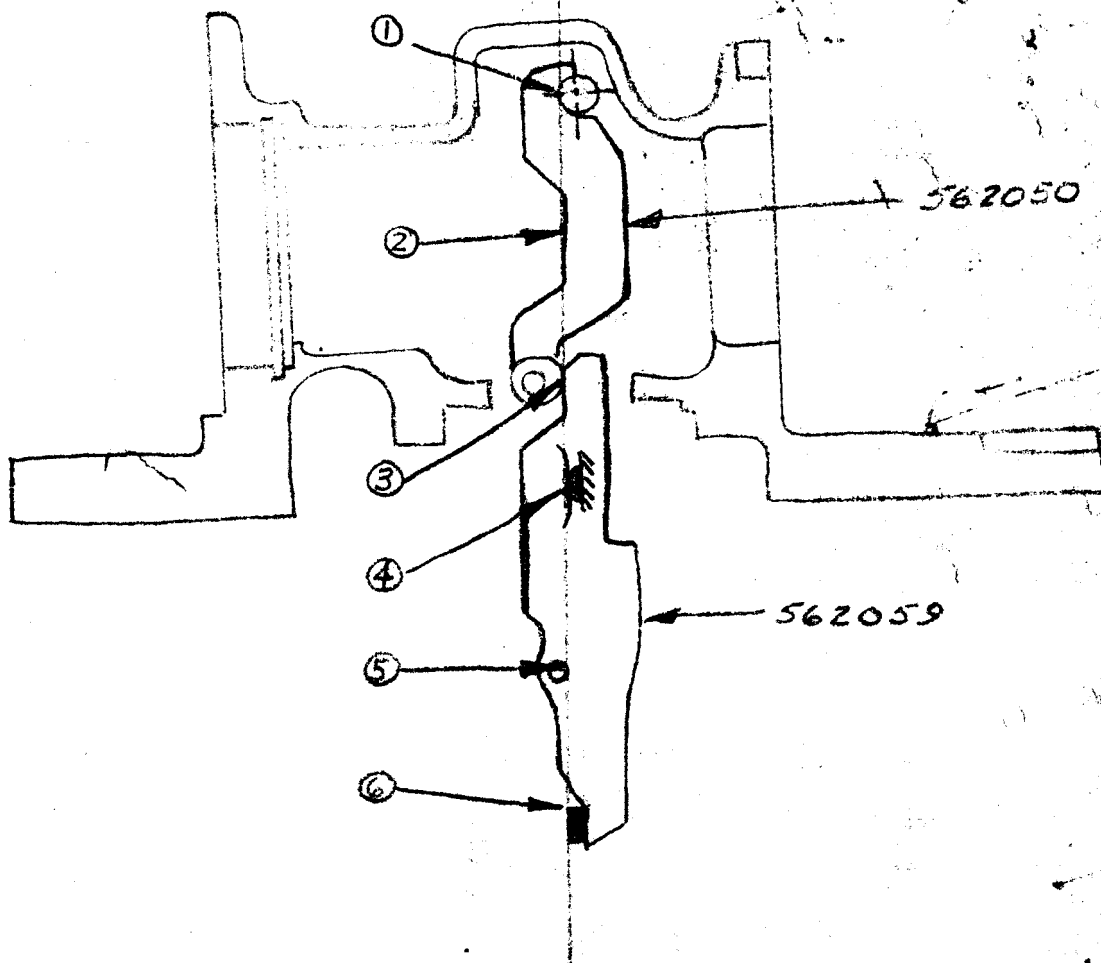
L 7208-23 ZONE II TRANSFER

## NOTE:

WHEN SETTING PIVOT TO ROLLER DIM. SET CDP SYSTEM SUCH THAT THE 3-D CHM BALL FOLLOWER IS IN THE 15 P.M. DETENT FOR CDP ROLLERS AND SET TV .014 OPEN WHEN SETTING T.V. ROLLERS.

TEMPERATURE SENSING  
SERVOSpec. No. HS13738  
Page 40 of 50

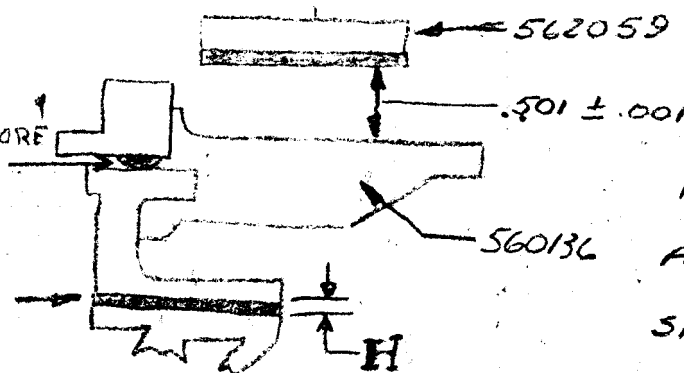
A DIM SHOULD EQUAL OR LESS THAN D+E  
IF D+E IS LESS THAN "A" MACHINE  
TO OBTAIN D+E TO BE .010-.015  
GREATER THAN A. AFTER MACHINING  
GET NEW A+E DIM FOR SHIMMING.

TEMPERATURE SENSING  
SERVOSpec. No. HS1373B  
Page 39 of 50

SET UP LEVERS 562050 AND 562059  
TO BE IN LINE AT POINTS ①, ②, ③, ④, ⑤  
AND ⑥

SURFACES  
MUST BE IN  
CONTACT BEFORE  
MEASUREMENTS  
ARE TAKEN.

558519



WITH 562059 SET AT  
ABOVE POSITION ADD  
SHIM 558519 UNDER BRACKET  
560136 SO THAT .501 DIM.

IS OBTAINED WHEN LEVER  
562059 & LEVER 560136 ARE PARALLEL

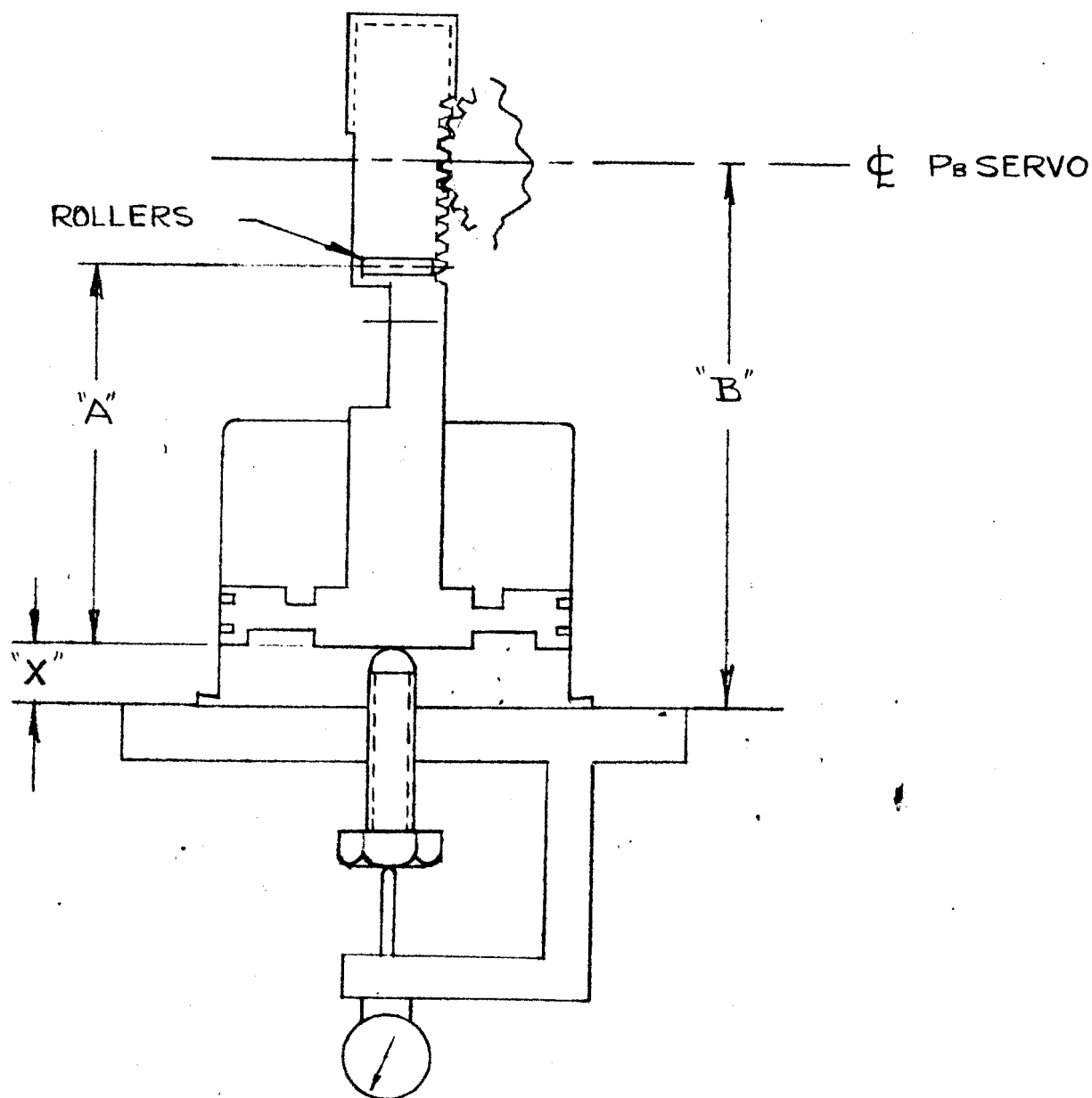
SHIM NOZZLES FOR  
.003 NULL GAUGE

L-7208-28 T<sub>T2</sub> SERVO

Spec No. HS1373B

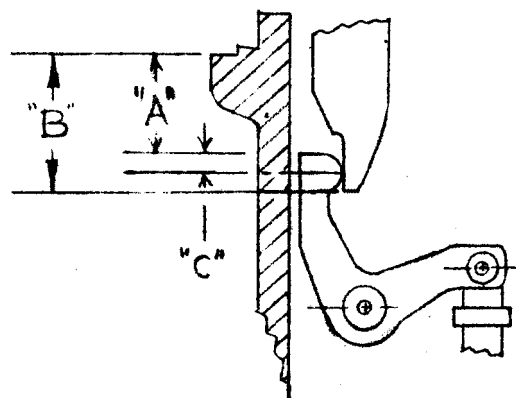
Page 37 of 37

ADJUST POSITION OF ROLLERS SO THAT AT  
PISTON POSITION FOR  $-65^{\circ}\text{F}$  DIM. "A" = "B" - "X" - .745  
DIM. "B" TO BE DETERMINED DURING INSP.



TRANSFER LINKAGE

Spec. No. HS1373B  
Page 36 of 50



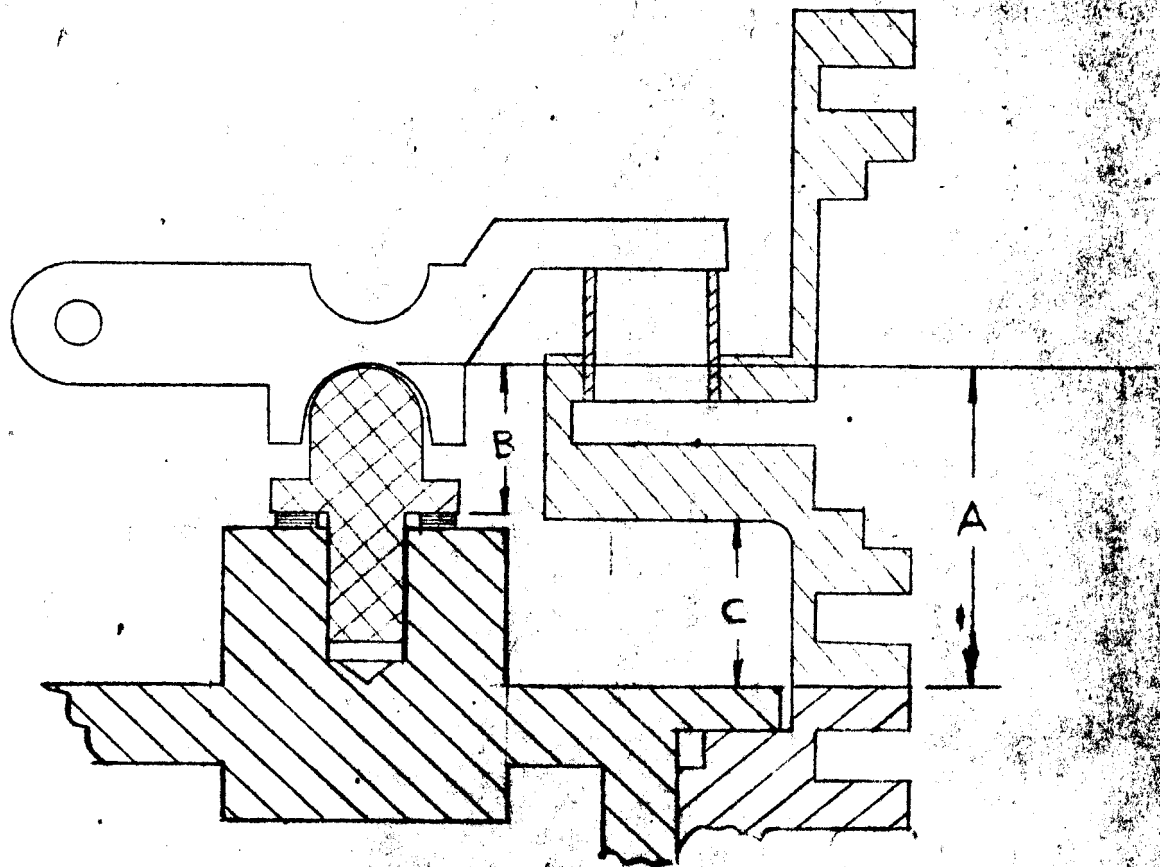
SHIM UNTIL DIM "B" IS EQUAL TO OR  
GREATER THAN DIM. "A" + "C"

## SHIMMING PROCEDURE

Fig -14

PRESS. REG. VALVE  
SENSOR  
CONTROL S/N \_\_\_\_\_

Spec. No. HS1573B  
Page 38 of 50



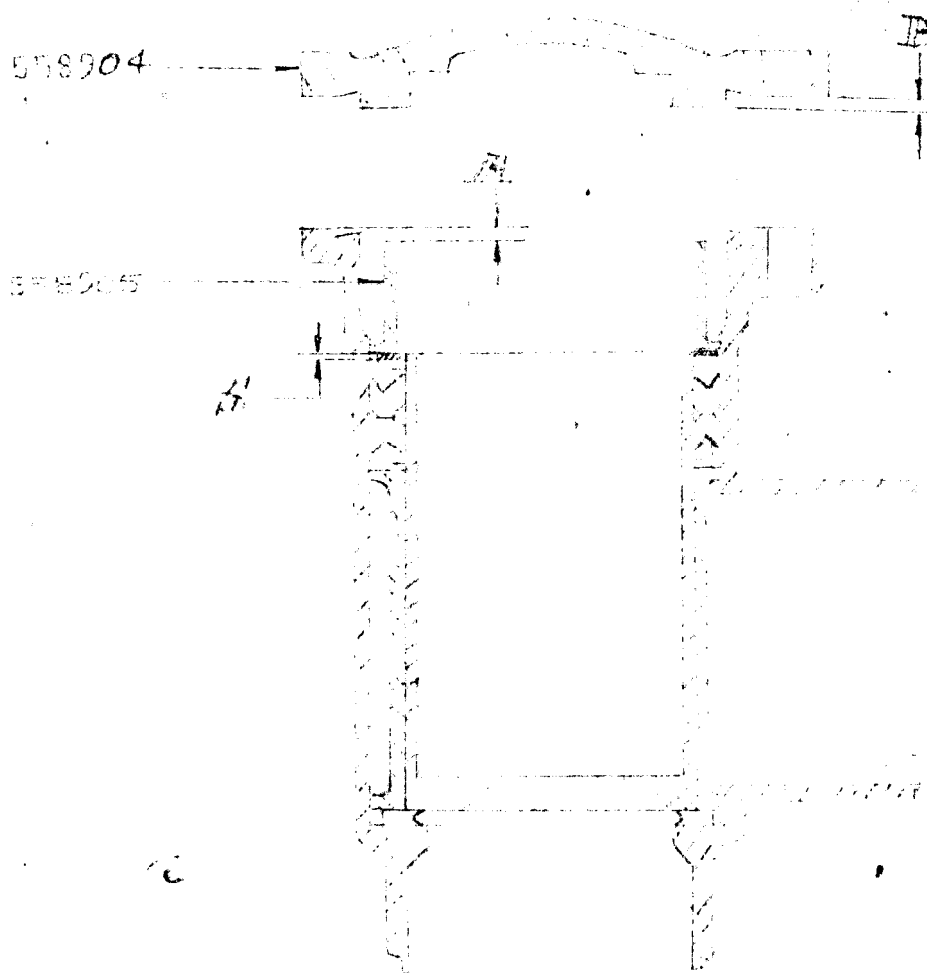
## SHIMMING

SHIM USED	REQ'D SHIM THICKNESS	SHIM ACT.	ASSY	INSP.
515298	$X = [A - (B + C)] + .015$			

Spec. No. NS1373B  
Page 10 of 11

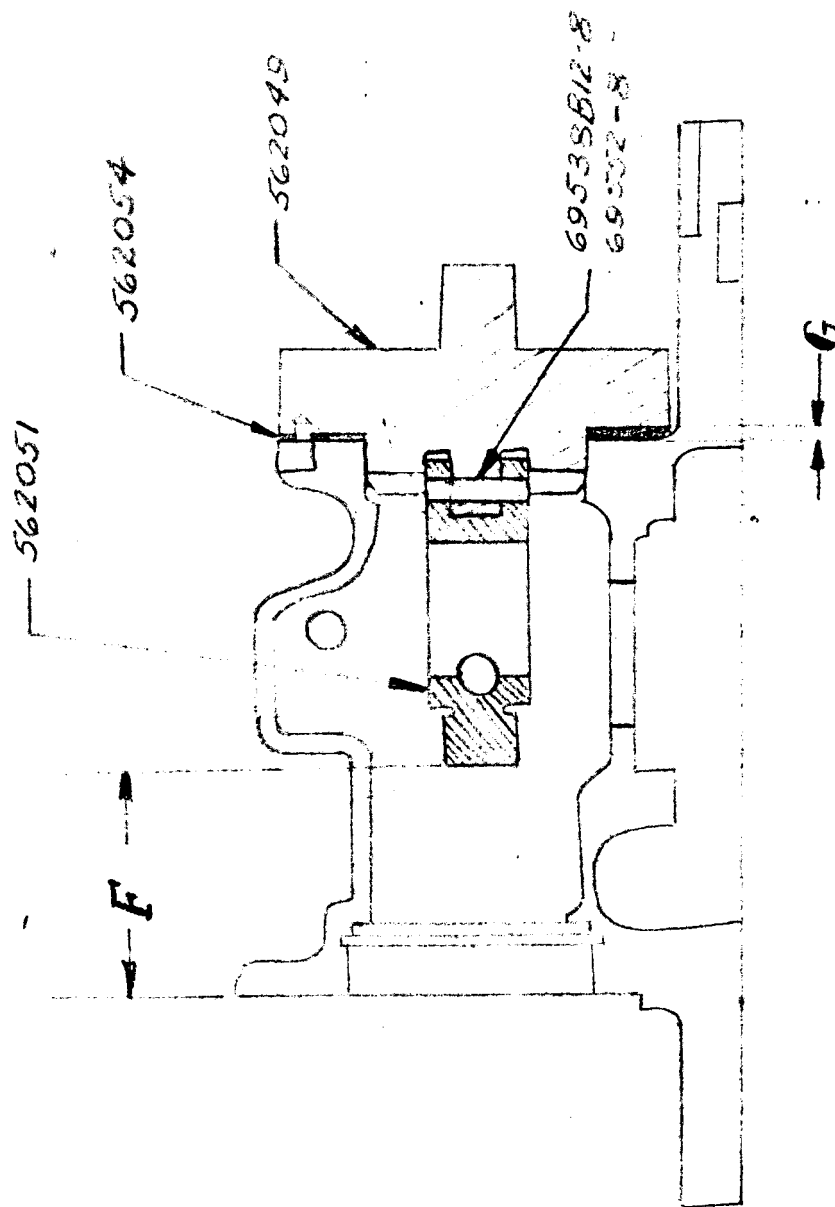
JFC 51

SHIMMING PROCEDURE FOR ZONE I MIN. PRESSURE AND  
SHUT OFF VALVE AND RECIRCULATION FLOW VALVE



SHIM THICKNESS  $S = A - B - .002$  To .004

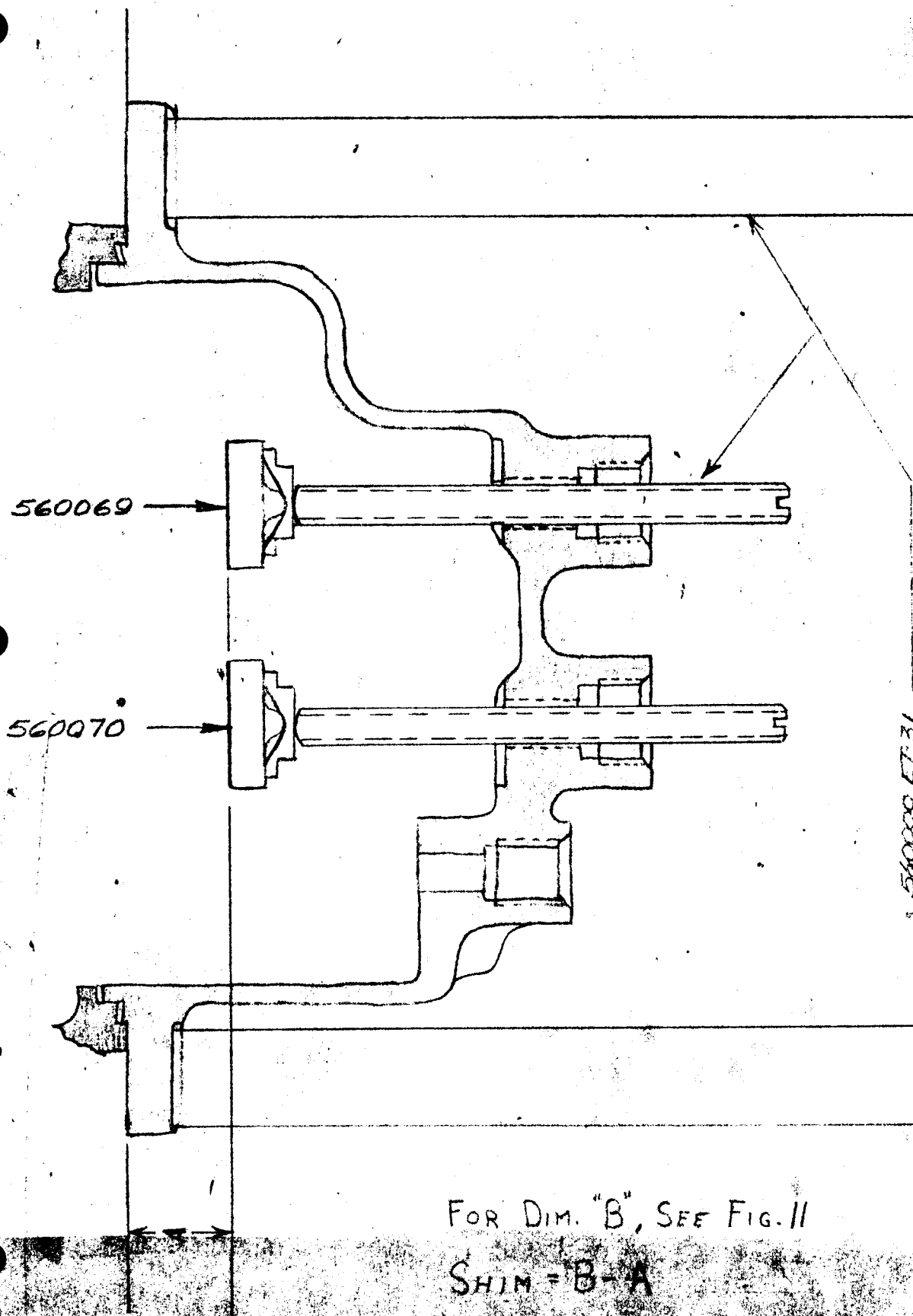
SHIM P/N: 569669



No Shim G (562054) = (X-E) + [D+E-A] ± .001

"C" DIM = "F" ± .300



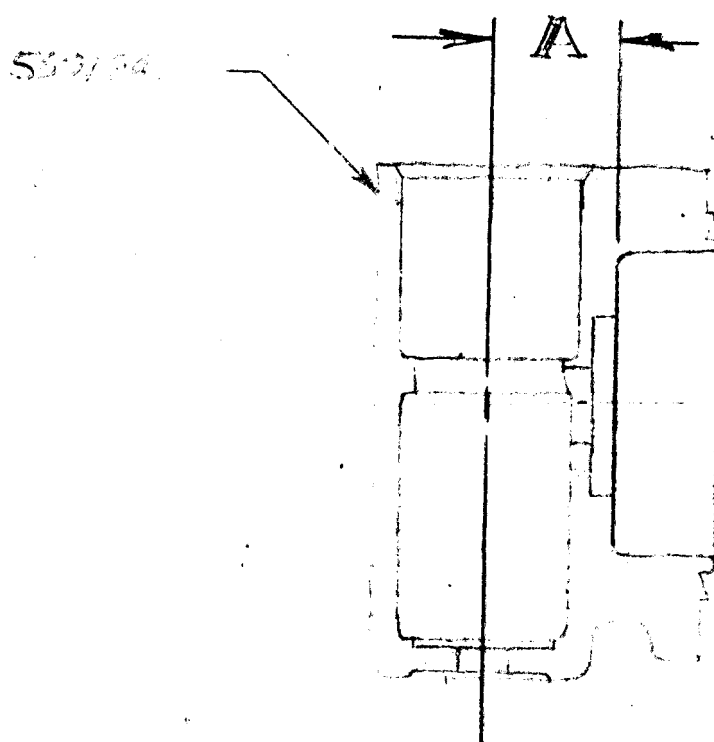


REPORT NO.

HAMILTON STANDARD

Spec. No. HS1373B  
Page 44 of \_\_\_\_\_

FIG. 20

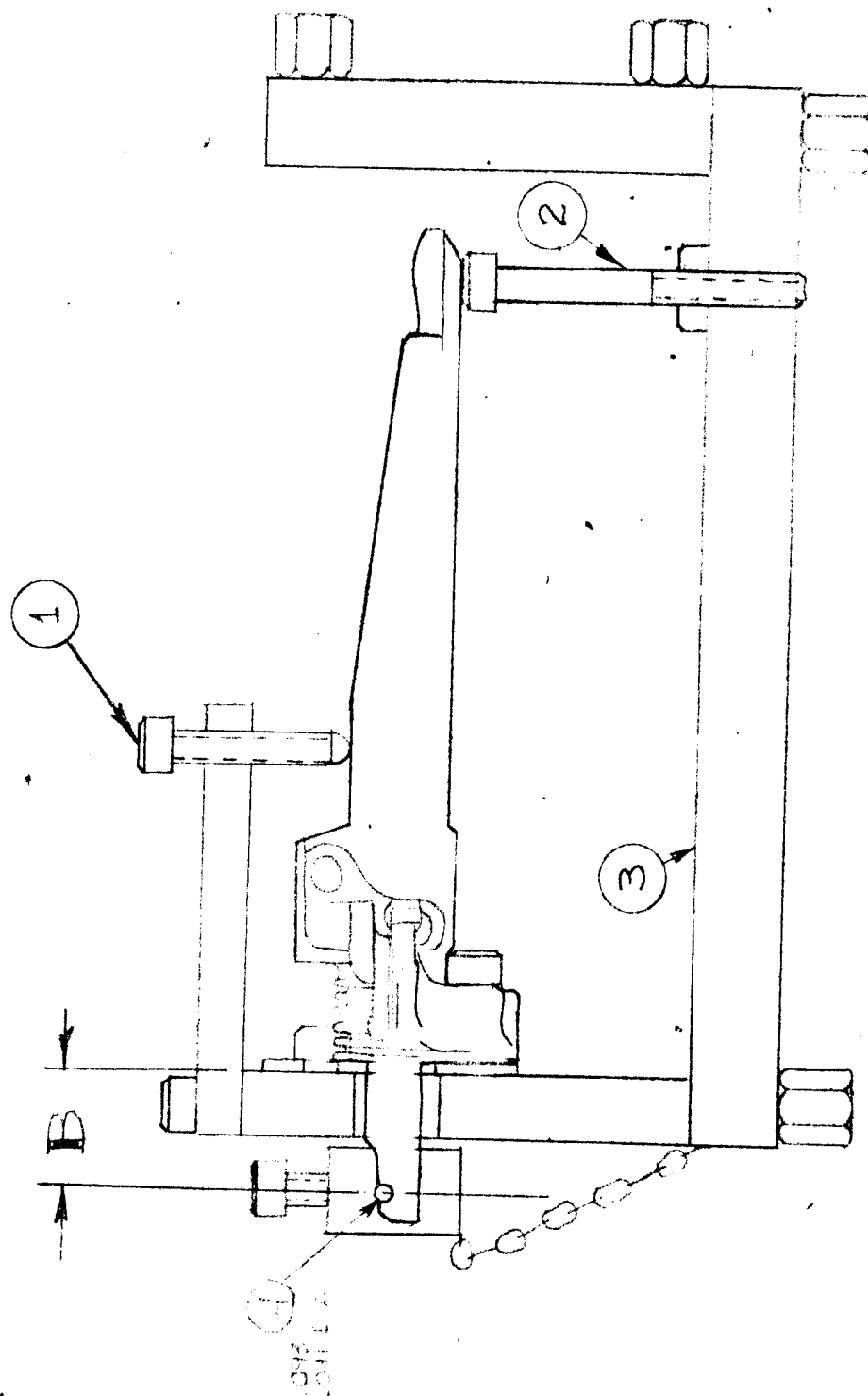


REPORT NO.

HAMILTON STANDARD

Spec. No. HS1373B  
Page 45 of

FIG. 2  
CDE LEVER AND-OFF LEVER



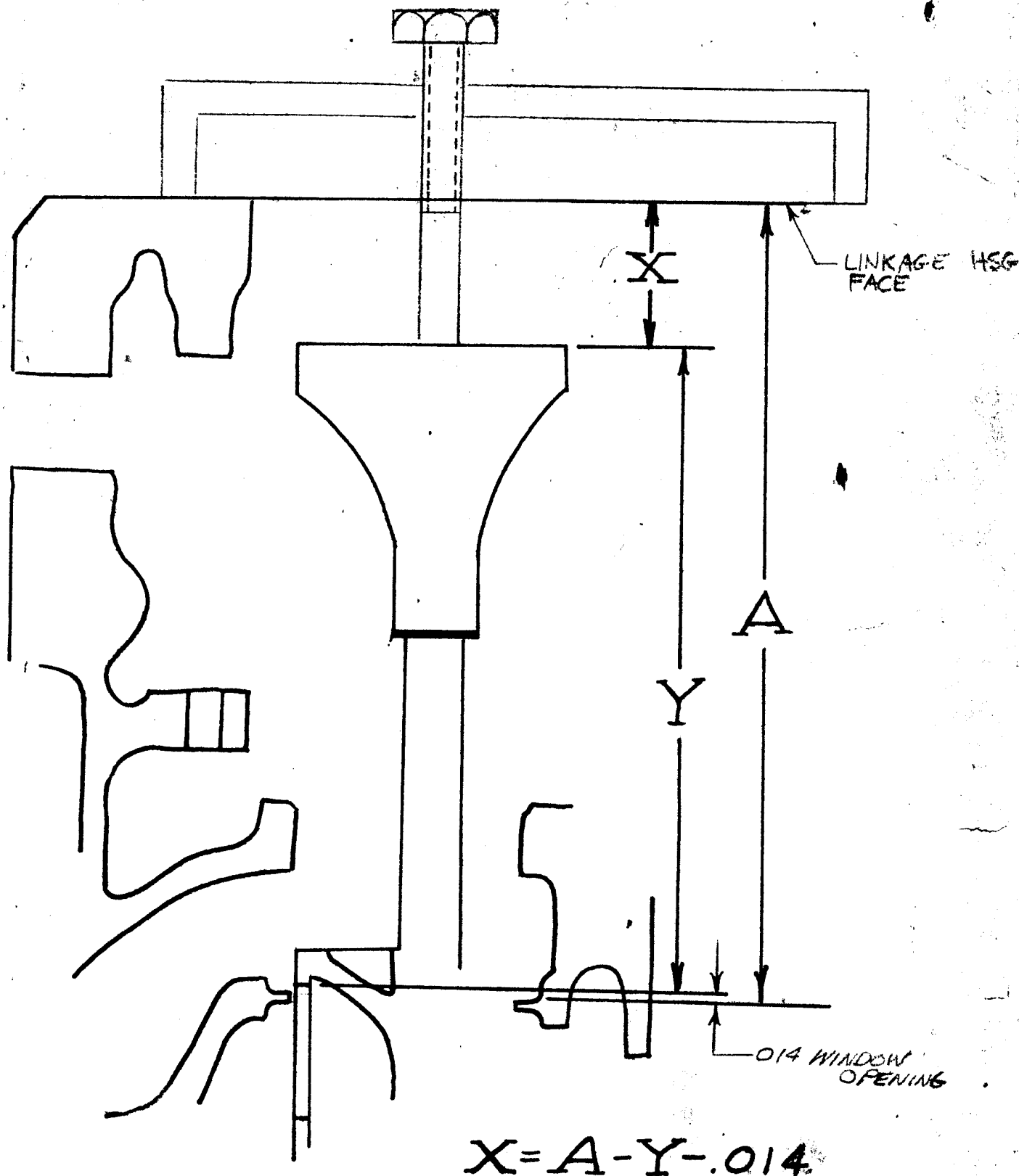
H. S. P-62

"ALBANERE" NO. 198L K&E CO., N. Y.  
REG. U. S. PAT. OFF.

L-7208-23 TRANSFER ROLLER  
SHIMMING PROCEDURE

FIGURE 22

Spec. No. HS1373B  
Page 46 of 50



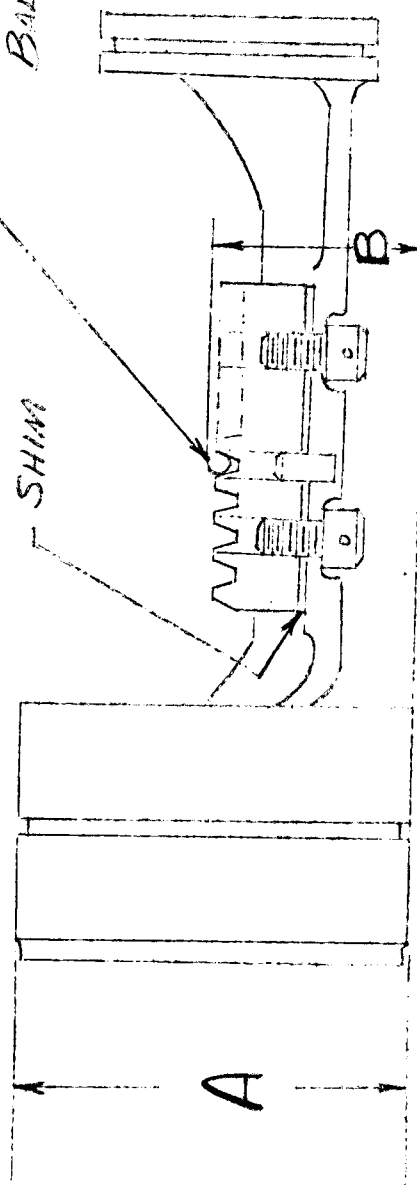
Spec. No. HS1373B

Page 47 of

L-7208-112 Two Piece Pump Control Power Piston

.1150 Measuring Wire Or  
Ball Diameter

SHIM

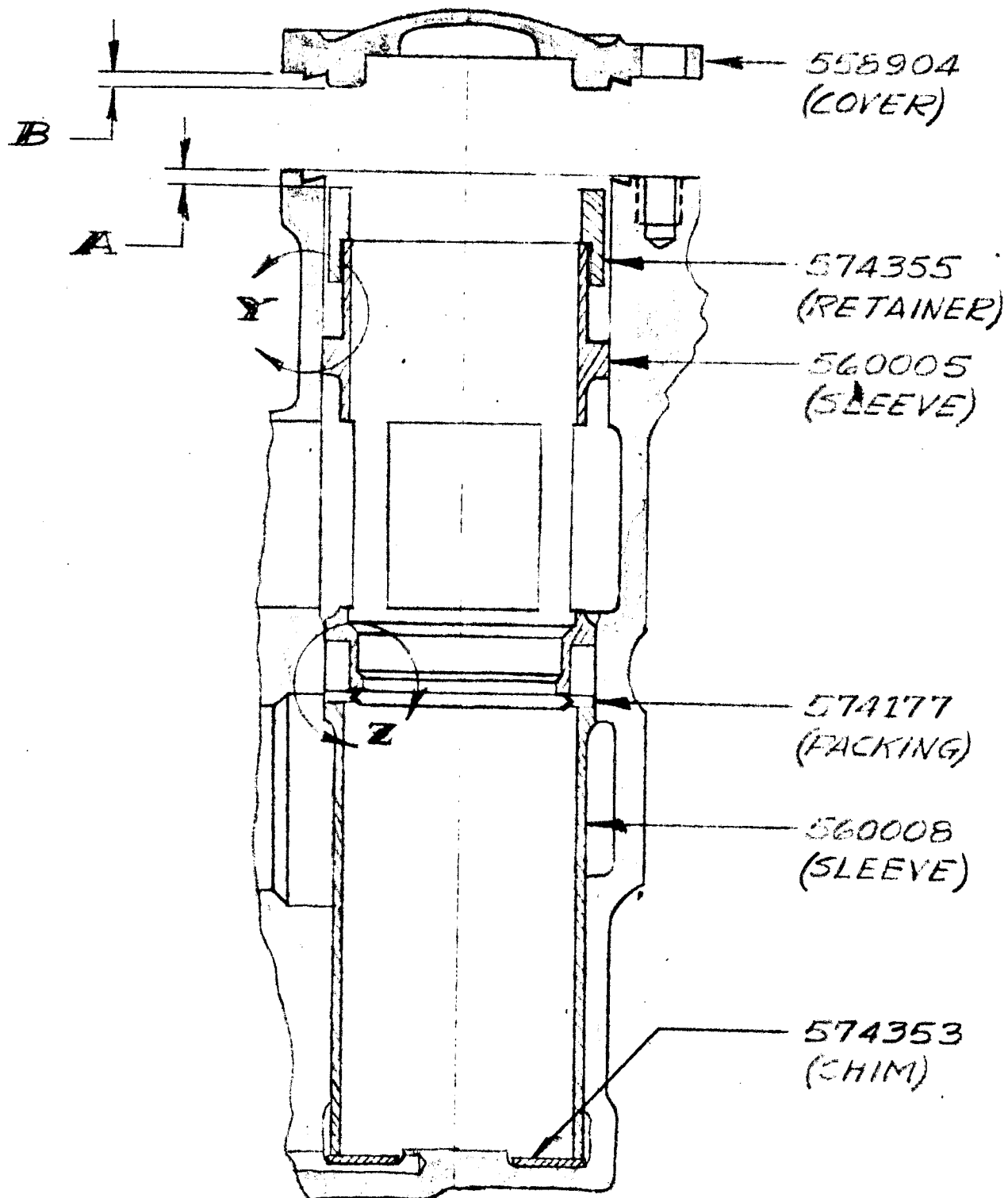


$$SHIM = B - \left( \frac{A}{2} + .068 \right) \pm .001$$

Spec. No. HS1373B

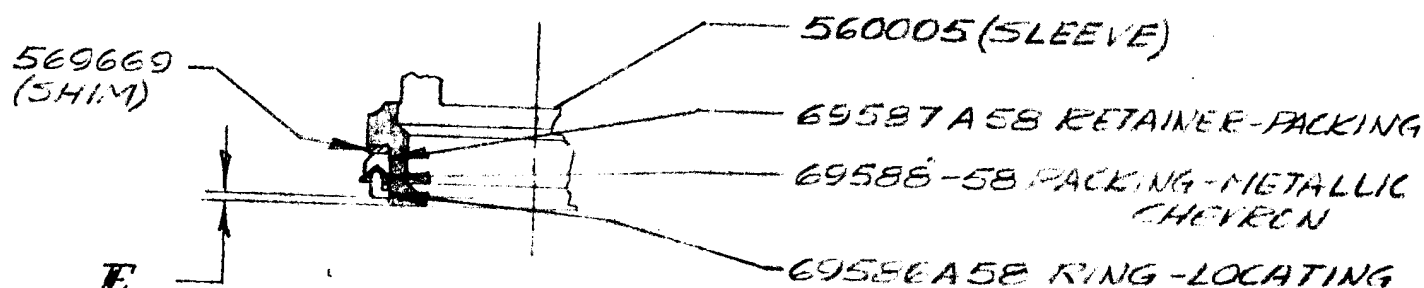
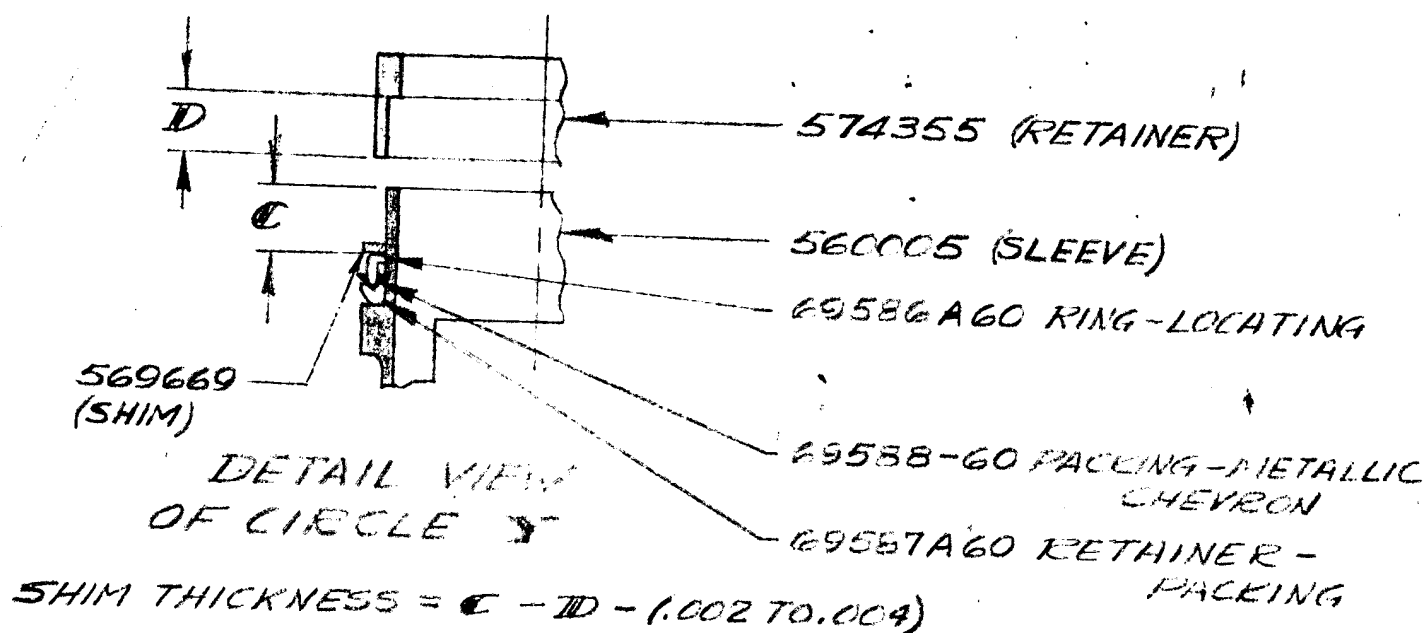
Page 48 of

# PEAK REG. VALVE & S.O.V. SHIMMING



SHIM THICKNESS =  $A - B - (.002 \text{ TO } .004)$

# SHIMMING - PEAK REG. VALVE & S.O.V. SLEEVE CHEVRON'S

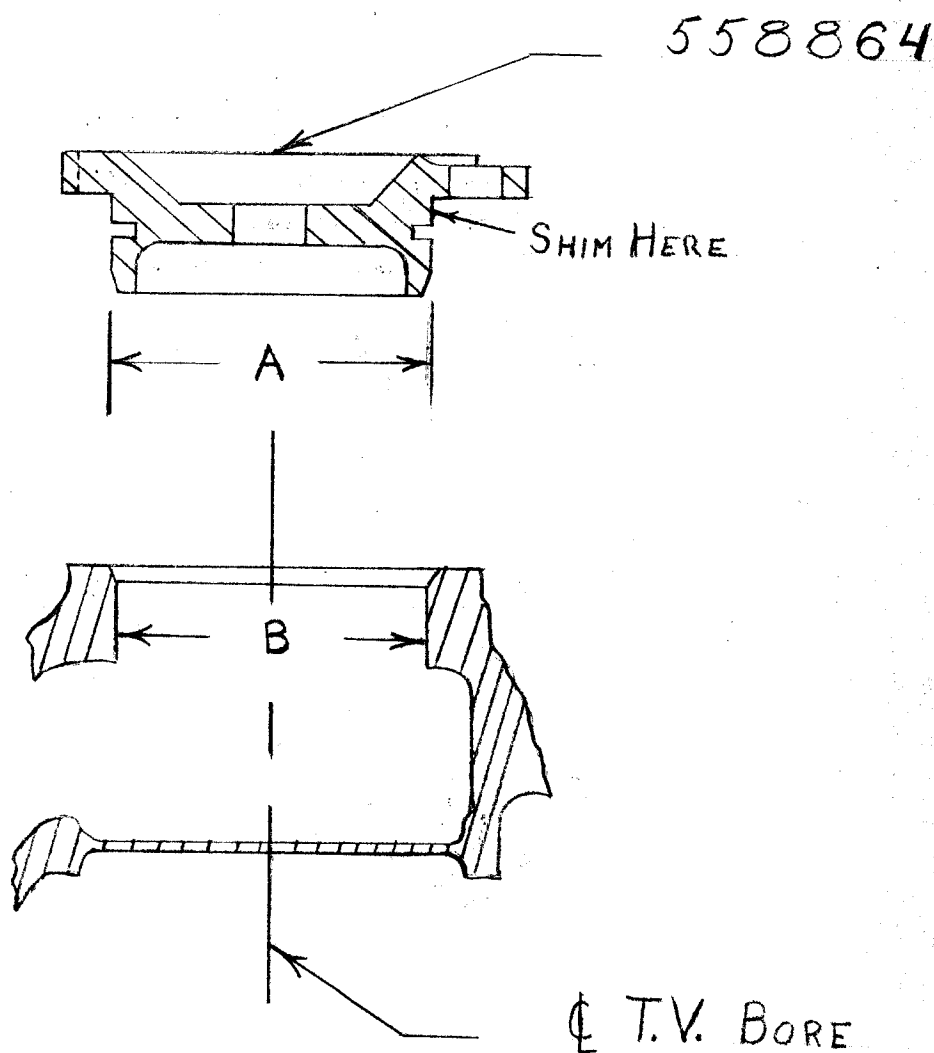


SHIM THICKNESS =  $E - (.002 TO .004)$

DETAIL VIEW OF CIRCLE Z

# T.V. COVER

FIG. 26  
Spec. No. HS1373B  
Page 50 of 50



SHIM THICKNESS =  $B - A$

USE SHIM SK45400

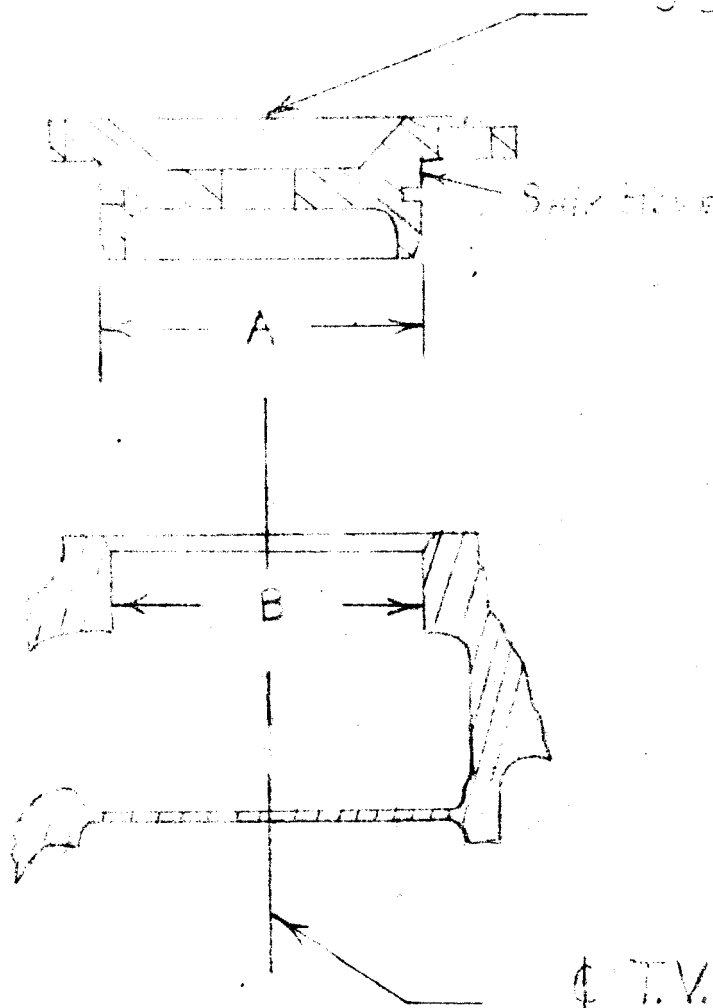


Spec. No. H21373B  
Page 20 of

# T.V. COVER

Spec. No. HS1373B  
Page 50 of 50

558564



SHIM (INCHES) = B-A

Use Shim SK 45400

HAMILTON STANDARD  
DIVISION OF UNITED AIRCRAFT CORPORATION  
WINDSOR LOCKS, CONNECTICUT

H.S. 1373B  
Amend.         
Page 1 of 12  
E. C. FF67626  
Date: 11-27-61

H.S. 1373B "Afterburner Control JFC-51 Acceptance of"

Amendment       

1. In paragraph 1.2.6.6 change that part which reads "0-80 psi" to read "0-150 psi."
2. In paragraph 1.3.2.4 change "PcB" to read "Pcb."
3. In paragraph 3.1 change from "all two outlets ....." to read "both outlets ..."
- 3A. In paragraph 4.1 change from "3.853  $\pm$  .002 ..." to read "3.880  $\pm$  .001 ..."
4. In paragraph 3.2 change from "gages across the total flow throttle valve and the peak ....." to read "gage across the total flow throttle valve, 150 across the peak ....."
5. In paragraph #5.1 change from "Set PLA; Max. increase ...." to read "Set PLA = Max., increase ....."
6. In paragraph 7.1 change from "Set PLA = max.  $P_B$  = 15." to read "Set PLA = max.,  $P_B$  = 15." Change from "Repeat at  $P_B$  = 50 & 100 differential....." to read "Repeat at  $P_B$  = 50 & 100, differential ....."
7. In paragraph 8.1 change from "increase  $P_B$  = 15  $\pm$  K, bleeds closed." to read "increase  $P_B$  to 15  $\pm$  K, bleeds closed."
8. In paragraph .9.2.1 change from "para.1.2.4 ...." to read "para. 1.2.3.1...."
9. In paragraph 10.5 change third sentence from "Adding shims ....." to read "Removing shims ....."
10. In paragraph #16.1 change from "See appendix B-1. For Limits hysteresis..." to read "See appendix B-1 for limits. Hysteresis ....."
11. In paragraph #17.1 change from "See appendix B-2. For limits hysteresis ..." to read "See appendix B-2 for limits. Hysteresis ....."
12. Appendix E-1 Delete table entitled:

<u>Wf Zone 2</u>	<u>AP</u>	<u>Injection</u>	<u>Manifold</u>	<u>Psi</u>
------------------	-----------	------------------	-----------------	------------

HAMILTON STANDARD  
DIVISION OF UNITED AIRCRAFT CORPORATION  
WINDSOR LOCKS, CONNECTICUT

H.S. 1373B  
Amend. 1  
Page 2 of 2  
E. C. FF67626  
Date: 11-27-61

H.S. 1373B "Afterburner Control JFC-51 Acceptance of"

Amendment 1

13. Appendix F, para. 3.2 change the last two sentences from:  
"subtract this amount of shims from the multiplying lever pivot bracket. Add if C.W." to read "add this amount of shims to the multiplying lever pivot bracket. Subtract if C.W."
14. Appendix F, para. 8.3 change from "B = .010 + gap ...." to read "B-.010 + gap ..."
15. Appendix F, para 10.1 change from "dimensions (A), (B), (C), and (D) ..." to read: "dimensions (A), (B), (C), (D), and (E)....."
16. Appendix F, para. 12.2 change from "balance bar (5600112)...." to read "balance bar (560112)....."
17. Appendix F, para. 12.6.1 change from "Shim thickness = B-A." to read "Shim thickness = A-B."
18. Appendix F, para. 13.4 change from "Shim thickness = S-A-B-(.002 to .004)". to read "Shim thickness S=A-B-(.002 to .004)."
19. Appendix F, para. 15.4 change from "Dim. C-F-300." to read "Dim C=F-.300."
20. Figure 3 change from "Dim. A=3.853 ± .002" to read "Dim. A = 3.880 ± .001"  
Figure 3 change from "Shim thickness = A ± 3.853" to read "Shim thickness = A ± 3.880"
21. Figure 10 change note callout from "apply 40#" to read "apply 70#."  
change note from "shim under nozzles to obtain .080 - .010 gap" to read "shim under nozzles to obtain .008 - .010 gap."
22. Figure 19 Change from "Shim = B-A" to read "Shim = A-B"
23. Figure 20 Change equation from "Shim = B-( $\frac{A + .068}{2}$ ) ± .001" to read "Shim = ( $\frac{A + .068}{2}$ ) - B ± .001."
24. Figure 26 Change equation from "Shim Thickness = B-A" to read "Shim Thickness =  $\frac{B-A}{2}$ "

HAMILTON STANDARD  
DIVISION OF UNITED AIRCRAFT CORPORATION  
WINDSOR LOCKS, CONNECTICUT

H.S. 1373B  
Amend. 2  
Page 1 of 1  
E. C. A268890  
Date: 5-12-62

H.S. 1373B "AFTERBURNER CONTROL JFC51 ACCEPTANCE OF"

Amendment 2

1. Change paragraph 1.2.1 to read:

1.2.1 "Test fluid will be PMC9073 for all testing except paragraph 24.0 where P & WA 523B must be used. Maintain control inlet and flow meter inlet at  $95^{\circ}\text{F} \pm 5^{\circ}\text{F}$ ."

2. Change paragraph \*24.1 to read:

\*24.1 "The following items shall be run at room temperature ambient conditions and fuel temperatures of  $150^{\circ} - 175^{\circ}\text{F}$  with P & WA 523B Fuel."

3. Change paragraph \*24.3 to read:

\*24.3 "The following items shall be run under room temperature ambient conditions and fuel temperatures of  $350^{\circ} - 375^{\circ}\text{F}$  with P & WA 523B Fuel."

**Page Denied**

**Hamilton Standard**

WINDSOR LOCKS, CONNECTICUT • U.S.A.

DIVISION OF UNITED AIRCRAFT CORPORATION

U  
A

SPEC. NO. HS 1509 D

CODE IDENT. NO. 73030

PAGE 2 OF

1.0 GENERAL INFORMATION1.1 SCOPE

This specification covers the method for testing the model JFC51 Afterburner Fuel Control 576400.

1.2 Equipment Required

Flow bench with a boost pump capable of supplying 10-70 psig fuel pressure to the main pumps in a closed loop system of operation. Main pumps capable of supplying 65000 PPH at 1000 psig pump discharge pressure. Two metered flow meters; Zone 1 and Zone 2. Zone 1 meter must be accurate to 0.5% in the 3000 PPH to 50000 PPH range and the Zone 2 meter must be accurate to 0.5% in the 1500-25000 PPH range. A recirculation line flowmeter accurate to 1.0% in the 350-5000 PPH range. An internal leakage flowmeter accurate to 2.0% in the 350-3000 PPH range. Pump discharge pressure to be controlled as a function of pump controller output thru a system of relief valves in pump discharge line.

1.2.1 Test fluid will be PMC9073 for all testing except paragraph 1.2.8 where P & WA 523B must be used. Maintain control inlet and flow meter inlet at  $100^{\circ} \pm 5^{\circ}\text{F}$ .

1.2.2 Pneumatic pressure source and two gages for simulating engine burner pressure capable of maintaining for a minimum period of 0.5 hour any pressure between 10 and 300 PSIA. One gage 0 to 300 psia accurate to  $\pm 0.25$  psia over a range of 50 to 300 psia.

1.2.3 Constant temperature baths capable of maintaining temperature of  $-65^{\circ}$ ,  $0^{\circ}$ ,  $+60^{\circ}$ , &  $+150^{\circ}$  within  $\pm 5^{\circ}\text{F}$ .

1.2.3.1 Temperature equipment to maintain temperatures from  $+150^{\circ}\text{F}$ . to  $+950^{\circ}\text{F}$ . during Hot testing. Temperatures to be accurate within  $\pm 10^{\circ}\text{F}$ .

1.2.4 Thermocouple and indicating unit with  $\pm 3^{\circ}\text{F}$ . accuracy for measuring temperatures between  $-65^{\circ}\text{F}$ . to  $300^{\circ}\text{F}$ . and with  $\pm 5^{\circ}\text{F}$ . accuracy between  $+300^{\circ}\text{F}$ . and  $950^{\circ}\text{F}$ .

1.2.5 Temperature cam calibration follower and dial indicator 560000 ET-7.

1.2.6 Gages for taking the following measurements within the specified accuracy.

1. Control proof pressure: 0-1500 psi with 1.0% accuracy of full scale reading.
2. Control inlet pressure (Pin): 0-1000 psi with 1.0% accuracy of full scale reading.

HAMILTON STANDARD  
DIVISION OF UNITED AIRCRAFT CORPORATION  
WINDSOR LOCKS, CONNECTICUT, U. S. A.

HS SPEC No 1509n  
Page 3 of       

1.2.6 Continued:

3. Control outlet pressure (Pout): Two gages Zone 1 and Zone 2: 0-1000 psi with 1.0% accuracy of full scale reading.
4. Control body pressure (Pcb); 0-150 psi with 1.0% accuracy of full scale reading.
5. Total flow throttle valve differential gage ( $\Delta$ PTFTV): 0-80 psi with .75% accuracy of full scale reading.
6. Peak flow throttle valve differential gage ( $\Delta$ PPFTV): 0-150 psi with .75% accuracy of full scale reading.
7. Pump Controller differential gage: 0-200 psi with .75% accuracy of full scale reading.
8. Rig boost pressure (Prb): 0-100 psi with 1.0% of full scale reading.
9. Spare Gages:
  1. 0-600 psi with 0.5% accuracy of full scale reading.
  2. 0-800 psi with 1.0% accuracy of full scale reading.
  3. 0-1000 psi with 1.0% accuracy of full scale reading (2 gages)

1.2.7 Separate pressure source capable of supplying 200 PPH at fuel pressures of 50-750 psig.

1.2.8 Provisions for testing the control at +350°F. Fuel Temperature with P & WA 523B Fuel.

1.2.9 Back pressure schedule as indicated in Appendix E-1.

1.2.10 Equipment to apply a 25-30 in-# CCW Torque to the pump control shaft.

1.2.11 Sanborn Recorder.

1.2.12 X-Y coordinate plotter.

1.2.13 Angular position indicator to supply pump control output shaft position input to Sanborn recorder.

1.2.14 Preliminary Checks

1.2.14.1 The fuel control shall be assembled using the shimming procedure in Appendix F of this specification. The procedure is to act as a guide only, and may be varied as necessary to satisfy control calibration flow schedule requirements.

1.2.14.2 All valves must be stroked in their mating bores through at least 100 cycles according to the stroke requirements listed in Appendix G. During cycling, Dominion A Spindle Oil obtainable from Atlantic Refining Co., 1351 Main St., East Hartford, Conn.



HSF-755.1A 5/61

**HAMILTON STANDARD**  
**DIVISION OF UNITED AIRCRAFT CORPORATION**  
**WINDSOR LOCKS, CONNECTICUT, U. S. A.**

SPEC. NO. HS 1509

CODE IDENT NO. 73030

PAGE 4 OF

1.2.14.2 Continued:

Note: One cycle consists of moving the valve from its original position through the desired stroke, and then returning the valve to the original position.

- Caution: During cycling, valve should not strike bottom of bore nor be withdrawn from its mating bore in a manner that would damage valve sharp edges.

1.3 Test Requirements

## 1.3.1 The following readings shall be recorded at each calibration point.

1. Total Metered Fuel Flow - - - - - Wft
2. Absolute Burner Pressure - - - - - PB
3. Inlet Bulb Temperature - - - - - TT2
4. Power Lever Angle - - - - - PLA
5. Compressor Bleed Position - - - - - CBA
6. Throttle Valve Differential - - - - - T.V.  $\Delta P$
7. Pump Controller Differential - - - - - P.C.  $\Delta P$

## 1.3.2 The following readings shall be recorded at the beginning and end of the variable input during calibration.

1. Control Inlet Pressure - - - - - PSIG - - - - - Pin
2. Control Outlet Pressure - - - - - PSIG - - - - - Pout
3. Test Fluid Temperature - - - - - °F
4. Control Body Pressure - - - - - PSIG - - - - - Pcb

## 1.3.3 The following readings shall be recorded when noted:

1. Zone 1 Fuel Flow - Wf1
2. Zone 2 Fuel Flow - Wf2
3. Peak Fuel Flow - Wfp
4. Arming Signal - PSIG
5. Transfer Point - Wf and PB
6. Pressure in recirculation line PR.

HS F-755.1 8/54

HAMILTON STANDARD  
DIVISION OF UNITED AIRCRAFT CORPORATION  
WINDSOR LOCKS, CONNECTICUT, U. S. A.

HS SPEC No 1509 D  
Page 5 of

1.3.4 The following abbreviations, in addition to the foregoing are used in this specification:

1. Clockwise -----CW
2. Counterclockwise -----CCW
3. Military PLA -----MIL\* (wide open throttle)

1.3.5 Accuracy of settings:

1. PB settings shall be held exact.
2. Tt2 settings shall be held to  $\pm 5^{\circ}\text{F}$ .
3. Wf shall be read exact.

2.0 INSPECTION REQUIREMENTS

2.1 The items marked with an asterisk (\*) in this specification are inspection items and as such must be under inspection surveillance.

2.2 Retest Requirements: If settings listed under "Reset" are re-adjusted or if assemblies or parts listed under "Replace" are replaced or removed for repair, the settings listed under corresponding "Retest" must be retested and settings not yet tested must be completed.

Reset

PB Servo (8.0)  
Temperature Servo (9.0)  
Total Flow T.V. (10.0)  
Zone 2 Transfer (12.0)  
Power Lever (6.1)

Retest

14.1.1, 14.2.1, 14.4.1, 14.4.2, 14.4.3  
14.1.1, 14.4.1, 14.4.2, 14.4.3  
14.1.1, 14.2.1, 14.4.1, 14.4.2, 14.4.3  
14.5.1, 14.5.2  
6.2, 6.3

Replace

Servo Housing  
Temperature Servo  
Transfer Housing  
Zone 1 Outlet Housing  
Zone 2 Outlet Housing  
Pump Controller

Retest

8.0, 14.1.1, 14.2.1, 14.4.1, 14.4.2, 14.4.3  
9.0, 14.1.1, 14.4.1, 14.4.2, 14.4.3  
12.0, 14.5.1, 14.5.2  
14.8.2.1, 14.8.2.2  
14.6.1, 14.8.1.3, 14.8.2.1, 14.8.2.2  
7.1, 7.2.1, 7.2.2

2.3 No adjustments or changes in parts shall be permitted during the final, inspected, test of the control.

HAMILTON STANDARD,  
DIVISION OF UNITED AIRCRAFT CORPORATION  
WINDSOR LOCKS, CONNECTICUT, U. S. A.

SPEC. NO. HS 1509D  
CODE IDENT NO. 73030  
PAGE 6 OF

### 3.0 INSTALLATION INSTRUCTIONS

- 3.1 Install control on drain table in a position similar to normal engine mounted position (Ref. P & WA layout 203578), connect Pump Discharge to Control Inlet, both outlets must be connected to separate flowmeters.. Recirculation and Internal Leakage lines must also be connected to separate flowmeters.
- 3.2 Install 80 psi differential gage across the total flow throttle valve, 150 psi across peak throttle valve, also install 200 psi differential gage across the total flow T.V. and inline regulator.
- 3.3 Install a separate fuel pressure source to the speed signal valve.
- 3.4 Make sure that there are no open fittings on control and the internal leakage line is not "dead headed."
- 3.5 The flowmeter density adjustments shall be set in accordance with actual density measurements during Hot Fuel Tests.

### 4.0 EXTERNAL LEAKAGE

- 4.1 With PLA at Max A/B, set boost pump pressure to  $60 \pm 15$  psig. There shall be no external leakage except:
  - a) No more than 100DPM from the PB drain.
  - b) No more than 300DPM from the Pump Controller Drain.

The term "no leakage" shall be defined as the permissible visual appearance of fluid on the external surface of a control which does not become progressively greater during a 5 minute period to such a degree that fluid runs off the surface of the control or forms droplets.

### 5.0 PROOF PRESSURE TEST

- 5.1 With PLA at max., increase Wf to  $10,000 \pm 500$  PPH. Close outlet valve until pin is  $1500 \pm 20$  psi. Maintain this pressure for a time period not to exceed 1 minute. There shall be no external leakage. Open outlet valve. The term "no leakage" shall be applied as defined in paragraph 4.1.

### 6.0 POWER LEVER SEQUENCE

- 6.1 Increase power lever angle until a position is reached where the PL Servo Piston moves .001-.005. Lock PL in place and adjust protractor slip ring until it reads 67°. At this position adjust the stop plate until the hole in the stop plate lines up with the slot in the index ring. Be sure protractor slip ring and stop plate are locked in position.  
**CAUTION:** Be sure PL servo piston is not hitting the min line stop (cover or screw in cover) when finding the .001 - .005 motion position.
- 6.2 Set PLA-Max. PB-15. Decrease PLA to 0°. Apply 150 psig to speed signal valve. Increase PLA to 67°. Adjust T.O.P.V. cam until the recirculation valve closes and the Zone I S.O.V. is open.  
**CAUTION:** Torque on adjusting screws to be 15-20 in-lbs.
- 6.3 With the same settings as 6.2, determine actuation by noting that when increasing the power lever, the signal pressure to the recirculation valve is Pin to Pin -20 psi, and the signal pressure to the Zone I S.O.V. is PBody +20 psi.

HSF-755.1A 5/61

## HAMILTON STANDARD

SPEC. NO. HS 1509B

DIVISION OF UNITED AIRCRAFT CORPORATION

CODE IDENT NO. 73030

WINDSOR LOCKS, CONNECTICUT, U. S. A.

PAGE 7 OF

7.0 PUMP CONTROLLER CALIBRATION

- 7.1 Set PLA = max., PB = 18. Adjust spring pre-load on pilot valve until pressure differential between sensor inlet pressure is 75-80 psi. Repeat at PB = 50 & 100 differential pressure must remain at 70 - 90 psi.

7.2 DYNAMIC PERFORMANCE\*7.2.1 Integration Rate

Disconnect pump controller shaft from Rig Output Flow Control. Set PLA at 120°, Tt2 at 60°F., Pb at 100 psia, bleeds closed; adjust Rig Output Flow Control to create a  $\Delta P$  (1-3) of 85 psi. Obtain a transient recording of  $\Delta P$  (1-3) and pump controller output shaft angular position while making a step change to decrease  $\Delta P$  (1-3) 5 to 9 psi below the pump controller setting. The angular rate of the pump controller output shaft shall be within 1/4 to 1/2 degrees per psi error per second.

\*7.2.2 Slew Rate Position

Disconnect Pump Controller Shaft from stand output flow control. Set PLA at 120°, Tt2 at 60°F., Pb at 100 PSIA, bleeds closed, adjust stand output flow to decrease  $\Delta P$  (1-3) the amount necessary to cause the Pump Controller Arm to move at its "Slew Rate".  $\Delta P$  (1-3) to get this slew rate shall be 8 to 12 psi below the Pump Controller setting. Shim under proportional piston spring to meet this requirement (Ref. Fig. 31)

\*7.2.3 Slew Rate

Disconnect pump controller shaft from stand motor control. Set PLA at 120°, Tt2 at 60°F., Pb at 100 psia, bleeds closed; adjust motor control to create  $\Delta P$  (1-3) of 85 psi. Obtain a transient recording of  $\Delta P$  (1-3) and pump controller output shaft angular position while making a step change to decrease  $\Delta P$  (1-3) 15 to 20 psi below the pump controller setting. The angular rate of the pump controller output shaft shall be at least 90° per second.

- 7.3 Set PLA = max. Increase PB until WF = 25000 PPH. Adjust sensor for inline regulator until differential across total flow T.V. is 40 psi.

8.0 PB SERVO CALIBRATION

NOTE: Refer to Build-up Sheet for Dim. K L-7208-12. If Dim. K is Plus (+) add this amount to the below PB pressures.

- 8.1 Set PLA = 68°, increase PB to  $30 \pm K$ , bleeds closed. Adjust PB position adjustment until cam follower is in bottom of the detent on the PB cam.

NOTE: Bottom of detent is determined by change of motion on dial indicator. Bottom of detent is located at point where indicator reverses direction no more than (.0001).

- 8.2 Increase PB to  $215 \pm K$ . Shim C.B.A. pushrod until cam follower is in bottom of high PB detent.

- 8.3 Repeat 8.1 and 8.2 until detents are set.

**Hamilton Standard**

WINDSOR LOCKS, CONNECTICUT • U.S.A.

DIVISION OF UNITED AIRCRAFT CORPORATION

**U  
A**

SPEC. NO. HS 1509 D

CODE IDENT. NO. 73030

PAGE 8 OF

- 8.4 Set PLA = 68°, bleeds open. Vary PB from 5 to 215. Locate low and high PB detents. Difference between detents must be  $155 \pm 2$  psi. Adjust CPA pushrod ball follower until this difference is obtained.
- 8.5 Set the bleeds in the closed position and determine that the Tt2 cam detents are still located at  $30 \pm K$  and  $215 \pm K$  psia.
- 8.6 Repeat items 8.1 thru 8.6 is required.
- 9.0 TEMPERATURE SERVO CALIBRATION
- 9.1 Set PB =  $30 \pm K$ , PLA = max, Tt2 = -65°F., bleeds closed. Adjust position spring on the Tt2 input lever until the cam calibration follower just starts to come out of the detent ( $\pm .0001$ ).
- 9.2 Set PB =  $30 \pm K$ , PLA = max. Tt2 = +950°F., bleeds closed. Adjust rate spring on the flapper until the cam calibration follower just starts to come out of the detent ( $\pm .0001$ ).
- 9.3 Repeat items 9.1 and 9.2 until the detents are set.
- 10.0 TOTAL FLOW THROTTLE VALVE CALIBRATION
- 10.1 Set PB = 50, PLA = 68°, Tt2 = 60°F., bleeds closed. Record total flow T.V. displacement and total metered flow. Increase PB until disp. changes .100. (T.V. rate is 95.4 PPH/.001). Wf must change by  $9540 \text{ PPH} \pm 100 \text{ PPH}$ . Adjust inline sensor  $\Delta P$  until set.
- 10.2 Bleeds closed, PLA=0, Tt2=+60°F., PB=200. Recirculation flow must be 3000 PPH. Adjust minimum flow stop until this Wf is obtained.
- 10.3 Set bleeds closed, Tt2 = 65°F. Set PLA = max and read Wf at 50 & 90 PB. Then set PLA = min and read Wf at 75 & 150 PB. Plot these readings. A straight line drawn thru 50 & 90 on the max line and 75 & 150 on the min line must intersect at -2 PSIA and -200PPH. The actual intersection will be defined by finite values of Wf and PB (Wf and Pb error).
- 10.4 Bleeds closed, Tt2 = -65°F., PB = 15, PLA = max. Adjust T.V. multiplying lever hinge until Wf error is reduced to -200pph.
- 10.5 If data lines determined in 10.3 do not intersect at -2 psia it will be necessary to reshim the T.V. multiplying lever hinge. Approx. .006 shims will change intercept 1 psi. Adding shims will move intercept to left (minus).
- 10.5.1 Set PLA = max, PB = 100, Tt2 = -65°F., bleed closed. Record Wf. Increase Tt2 to +300°F. and record Wf. Differential Wf between -65°F. and +300°F. must be  $6700 \pm 250 \text{ PPH}$ . Adjust the Tt2 cam bias adjustment until this differential is obtained.
- 10.6 PLA = 67°, PB = 100, Tt2 = +60°F., bleeds closed. Adjust power lever servo pilot valve position until Wf = 7420 PPH.
- 10.7 Set PLA = Max., PB = 100, Tt2 = -65°F., bleeds closed. Adjust the power lever rate adjust (linkage bracket) until Wf = 43,000 PPH. At this time check stroke of the power lever servo. Stroke must be  $.900 \pm 100$  for full power lever movement.
- 10.8 Recheck 10.6 and 10.7, as slight trimming adjustment may be necessary.

HSF-755.1A 5/61

**HAMILTON STANDARD**  
**DIVISION OF UNITED AIRCRAFT CORPORATION**  
**WINDSOR LOCKS, CONNECTICUT, U. S. A.**

SPEC. NO. HS 1509D

CODE IDENT NO. 73030

PAGE 9 OF       

10.8.1 Range of Remote Trim adjustment (PL Servo Rate):  
 Set PB = ~~100~~; Tt2 = +60°F; PLA = Max. Turn adjustment clockwise until it bottoms and record total Wf. Turn adjustment ccw until it bottoms and record total Wf. Limits: Adjustment range must be at least 14% of Wf as calibrated. Range determined with this check must be recorded on the final data sheet. Note: Do not repeat this test during final calibration.

10.9 Set PB = 100, Tt2 = +60°F, bleeds closed. At these conditions increase PLA until Wf is 13300 PPH. Adjust power lever stop to contact piston at this flow.

10.10 Set PB = 30 psia; PLA = 120°, Tt2 = +750°F; bleeds open. Wf must be 12390 - 13690 pph. Trim to obtain this Wf by a P.L. servo position adjustment.

11.0 POWER LEVER TORQUE

11.1 Maximum Power Lever Torque throughout the operating range shall be no greater than 20 in-lbs.

12.0 ZONE 2 MANIFOLD TRANSFER

12.1 Pressure in "Y" line must build up to within 10% of its final value within .25 seconds measured from the time it starts to increase. Select bleed size to meet this requirement.

12.2 Set PLA = 65°, PB = 50, Tt2 = +60°F, bleeds closed. Increase PLA and determine actuation point of the Zone 2 manifold. The Zone 2 manifold must actuate at 13200-14600 pph. Adjust the C.D.P. transfer power spring to set the correct actuation point.

12.3 Set PLA = 65°, PB = 18, Tt2 = +60°F, bleeds closed. Increase PB = 100, increase PLA and determine actuation point of the Zone 2 manifold. The Zone 2 manifold must actuate at 26400-29200.

12.4 Check retransfer (Zone II closes on decreasing PL) according to note in Appendix D.

13.0 PEAK THROTTLE VALVE RATE

13.1 Set PLA = 120°, PB = 50, Tt2 = +60°F bleeds closed. Record Wf in Zone 1. Increase PB to 150 and record Wf in Zone 1. Difference in Wf between 50 and 150 PB must be 22500-23500 PPH. Adjust peak valve sensor until this difference is obtained.

14.0 FINAL CALIBRATION

- Note: 1. A torque of 25-30 in -# shall be applied to the Pump Control Output Lever through out the final calib.  
 \* 2. A body press. of 50 ± 20 psig shall be maintained throughout final calibration.  
 \* 3. No adjustments or changes of parts shall be permitted during the final calibration.

14.1 MAX RATIO CALIBRATION - BLEED CLOSED

**Hamilton Standard**

WINDSOR LOCKS, CONNECTICUT • U.S.A.

DIVISION OF UNITED AIRCRAFT CORPORATION

**U  
A**

SPEC. NO. HS 1509 D

CODE IDENT. NO. 73030

PAGE 10 OF

- \*14.1.1 Set PLA = 120°, Tt2 = +60°F., bleeds closed. Record total metered Wf, T.V.  $\Delta$  P, and P.C.  $\Delta$  P at the following PB pressures (Note: Approach PB pressures in increasing direction. PB = 18, 30, 40, 50, 75, 85, 120, 145, 180, 200, 145, 85, 50 and 18 psia. See appendix A-1 for limits. Hysteresis must be within the limits defined in appendix A-1. Record return to Pump Inlet Flow at 18 & 200 psia.
- 14.2 MIN RATIO CALIBRATION - BLEEDS CLOSED
- \*14.2.1 Set PLA = 68°, Tt2 = 60°F., bleeds closed. Record total metered Wf, T.V.  $\Delta$  P, and P.C.  $\Delta$  P at the following PB pressures; 18, 40, 100, 200, 100 and 40 psia. See appendix A-2 for limits. Hysteresis must be within the limits defined in appendix A-2. (Note: Do not overshoot when setting PB pressures.)
- 14.3 POWER LEVER SEQUENCE AND TRANSIENT
- \*14.3.1 Set PLA = 120°, Tt2 = +60°F., PB = 18, bleeds closed. Decrease PLA to 0°, then slowly increase PLA. At 66° - 67° the recirculation valve must close at or after the time at which the Zone I primary manifold S.O.V. opens. Increase PLA to 120°. Slowly decrease PLA and record PLA at which S.O.V. closes. PLA must be within 65° - 67° when S.O.V. closes. Recirculation valve must open at or before the time at which the S.O.V. closes.
- \*14.3.3 Set Pb = 100 psia and Tt2 = +60°F. Change PLA from 67° to 120° within .8 to 1.2 seconds. The control fuel flow shall increase at a rate not to exceed 300 Wf/Pb ratios per second and complete 90% of the transient in 2 seconds or less.
- \*14.3.3 Set Pb = to 100 psia and Tt2 = to +60°F. Change PLA from 120° to 67° within .8 to 1.2 seconds. The control fuel flow shall complete 90% of the transient in 2 seconds or less.
- \*14.3.4 Set Pb = 100 psia and Tt2 = +60°F. Bleeds closed. Maximum Power Lever Torque throughout the operating range shall be no greater than 20 in-lbs.
- 14.4 TEMPERATURE (Tt2) SENSING CALIBRATION - (See Appendix C-1 for limits)  
NOTE: All temperatures (Tt2) to be actual bulb temp. for final calibration.
- \* 14.4.1 Set PLA = max, Tt2 = -65°F., bleeds closed. Record total metered Wf at the PB pressures noted in Appendix C-1. (Note: Approach PB pressures in increasing direction.)
- \*14.4.2 Repeat item 14.4.1 at temperatures (Tt2) of +150°F, +300°F.
- \*14.4.3 Repeat item 14.4.1 with bleeds open at Tt2 of +300°F, +550°F. & +750°F.
- \*14.4.4 The force required to open and close CBA pushrod shall not exceed 25 lbs., when body pressure is at 50 psig.
- 14.5 MANIFOLD TRANSFER AND PEAK SYSTEM CALIBRATION
- \*14.5.1 In the following calibration record Zone I Fuel Flow (Wf1) at the manifold transfer points. A coordinate system plotter (X,Y) is required for this calibration. A plot of Wf1 vs PB shall be made for all calibration points. An indication must appear on the chart when the Zone II regulator opening pressure increases a minimum of 50 psi above control body pressure. This pressure increase indication must occur within the transfer limits defined in Appendix D-1. At each of the specified PB settings decrease PLA. from max at a rate no faster than 2°/sec until retransfer occurs. Retransfer shall occur within the limits specified in Appendix D-1.

**Hamilton Standard**

WINDSOR LOCKS, CONNECTICUT • U.S.A.

DIVISION OF UNITED AIRCRAFT CORPORATION

U  
A

SPEC. NO. HS 1509 D

CODE IDENT. NO. 73030

PAGE 11 OF

- \*14.5.2 Set PLA = 68°, PB = 18, Tt2 = +60°F., bleeds closed. Increase PLA no faster than 2°/sec. record transfer and peak flow points at PB of 18, 30, 50, 100, 150 and 180. See Appendix D-1 for limits.
- \*14.5.3 Repeat 14.5.2 with bleeds open. See Appendix D-1 for limits.
- 14.6.0 RECIRCULATION CALIBRATION
- \*14.6.1 Set PLA = 0°, PB = 100 psia, Tt2 = +60°F., bleeds closed. Metered Wf must be 2850 - 3150 pph. Record control inlet pressure and control body pressure. Control inlet pressure must be within 80-250 psi above control body pressure.
- 14.7.0 REPEATABILITY CHECKS
- 14.7.1 Check repeatability in accordance with and in sequence indicated in Appendix H.
- 14.7.2 Re-run per paragraph 14.7.1 two additional times. Re-run paragraph 14.7.1 a total of 9 additional times only if requested by HS Engineering. Cycle bleeds open to bleeds closed twice before starting each re-run.
- 14.8.0 LEAK CHECK
- \*14.8.1 With all instrumentation removed from control, set the PLA at 120°, set PB at 150 psia, Tt2 at +60°F., bleeds closed.
- \*14.8.1.1 Check external leakage. No leakage allowed except for overboard drain and PB drain.  
  
The term "no leakage" shall be defined as the permissible visual appearance of fluid on the external surface of a control which does not become progressively greater during a 5 minute period to such a degree that fluid runs off the surface of the control or forms droplets.
- \*14.8.1.2 Check overboard drain leakage. Allowable leakage shall be no more than 10 dpm from the PB drain and 30 dpm from the pump controller drain.
- \*14.8.1.3 Remove recirculation line from the control and check recirculation valve leakage. Leakage from the recirculation port must not exceed 20 cc/min.
- 14.8.1.4 Pressurize overhead drain port on pump controller to 35-40 psig. The external leakage shall not be greater than 8 drops per minute per seal.
- \*14.8.2 Shut-Off Valve Leakage  
Note: Allow 3 to 5 minutes for lines to drain before taking leakage reading.
- \*14.8.2.1 Set PLA = 0°, Tt2 = +60°F., PB=15, bleeds closed, with main and boost pumps operating. Remove zone I and zone II outlet lines. Leakage in zone I and zone II must not exceed 10 dpm in either line. Shut down main pump.
- \*14.8.2.2 Set PLA=0°, Tt2=+60°F., PB=15. Maintain Boost Pressure at 50 psig. Remove Zone I and Zone II outlet lines. Leakage must not exceed 10 dpm in either line.
- 14.9.0 Power Lever Cam Calibration Check
- \*14.9.1 Set PB of 100 PSIA; Tt2=+60°F. Set, in sequence, power lever angles of 68°, 75°, 85°, 95°, 105°, 120°, 95°, 75°, 68°. Record total Wf at each point.
- \*14.10.0 The "K" dimension used in setting up the PB system position must be recorded on the final data log sheets.
- 15.0 PRESERVATION AND STORAGE
- 15.1 At conclusion of bench calibration, drain the calibrating fluid from the control and prepare the control for shipment in accordance with H.S. Spec. 380.
- 15.2 The "dry" weight of the control shall be recorded on the installation inspection sheet.



**HAMILTON STANDARD**  
**DIVISION OF UNITED AIRCRAFT CORPORATION**  
**WINDSOR LOCKS, CONNECTICUT, U. S. A.**

SPEC. NO. HS 1509 D

CODE IDENT NO. 73030

PAGE 12 OF

APPENDIX A-1

<u>PB</u>	<u>Conditions</u>	<u>Total Wf Limits</u>
18	Tt2 = 60°F	6090 - 6730
30	Bleeds	10070 - 11130
40	Closed	12880 - 14260
50		16110 - 17810
75	PLA = 120°	24520 - 27100
85		29350 - 32440
120		43900 - 48530
145		46420 - 51310
180		57100 - 63110
200		60420 - 66780

APPENDIX A-2

<u>PB</u>	<u>Conditions</u>	<u>Total Wf Limits</u>
18	Tt2 = 60°F	2850 - 3150
40		5050 - 5590
100	Bleeds Closed	12635 - 13965
200	PLA = 68°	25270 - 27930

APPENDIX C-1Temperature Sensing Calibration

Tt2 = -65°F B.C.

<u>PB</u>	<u>Total Wf Limits</u>
18	7110 - 7860
60	23660 - 26160
100	40830 - 45130
150	58100 - 64220
180	60220 - 66560

Tt2 = +150° B.C.

<u>PB</u>	<u>Total Wf Limits</u>
18	5900 - 6520
60	19610 - 21680
100	34140 - 37730
150	49240 - 54430
180	58510 - 64670

Tt2 = +300°F B.C.

<u>PB</u>	<u>Total Wf Limits</u>
18	6210 - 6870
60	20710 - 22890
100	34490 - 38120
150	51100 - 56490
180	60120 - 66450

Tt2 = +550°F B.C.

<u>PB</u>	<u>Total Wf Limits</u>
18	7350 - 8120
60	27490 - 30390
100	45920 - 50753
150	60420 - 66780
180	60420 - 66780

## HAMILTON STANDARD

SPEC. NO. HS 1509D

DIVISION OF UNITED AIRCRAFT CORPORATION

CODE IDENT NO. 73030

WINDSOR LOCKS, CONNECTICUT, U. S. A.

PAGE 13 OF

Tt2 = +750°

## APPENDIX C-1 (continued)

<u>PB</u>	<u>Total Wf Limits</u>
18	7810 - 8630
30	12390-13690
40	17400-19230
50	21750-24040
80	34740-38400
100	43100-47640
150	60420-66780
180	60420-66780

PB  
18  
60  
100  
150  
180

Tt2 = 300°F B.O.

The observed flow readings shall be 19% to 21% higher than the observed flow readings for Tt2 = 300°F B.O.

Notes: Hysteresis Wf must be within specified limits

## APPENDIX D-1

<u>PB</u>	<u>Transfer Wf B.C.</u>
18	4750 - 5260
30	7920 - 8760
50	13200-14600
100	26400-29200
150	39600-43800
180	47400-52600

Peak Wf B.C.

Peak Wf &amp; Transfer Wf. B.O.

3930-4350  
6550-7250  
10900-12100  
21800-24200  
32700-36300  
39300-43600

The observed flow readings shall be 19% to 21% higher than the observed flow readings for transfer bleeds closed.

Notes: On decreasing PL excursion the control must retransfer within the following limits:

- A) At PB values of 50 psia or less retransfer must occur at least 200 PPH below but no greater than 500 pph below the increasing Transfer Fuel Flow.
- B) At PB values above 50 psia retransfer must occur at least 200 PPH below but no greater than 10 ratio units below the increasing Transfer Fuel Flow.

HSF-753.1A 5/61

HAMILTON STANDARD  
DIVISION OF UNITED AIRCRAFT CORPORATION  
WINDSOR LOCKS, CONNECTICUT, U. S. A.

SPEC. NO. HS 15099

CODE IDENT NO. 73030

PAGE 14 OF

APPENDIX E-1

<u>Wf</u>	<u>ZONE I</u>	<u>Injection Manifold (PSI)</u>
3000	90 - 110	
6000	140-165	
10000	195-225	
20000	300-345	
30000	390-440	
40000	460-520	

NOTE: Zone II manifold press. shall be maintained at a pressure which is 75 psi  $\pm$  10 psi below Zone I back pressure at test point.

HAMILTON STANDARD  
DIVISION OF UNITED AIRCRAFT CORPORATION  
WINDSOR LOCKS, CONNECTICUT, U. S. A.

HS SPEC No 1507D  
Page 15 of

APPENDIX F

JFC-51 SHIMMING INSTRUCTIONS

**Note:** These shimming instructions are to be used for initial buildup. Final shim thickness and setting dimensions may be varied to meet the final flow calibration.

1. Power Lever Indexing (REF. L-7208-24; Et-1)

Determine Max. A/B stop, decrease power lever 53° from this point. Insert index pin through the hole in the protractor, index ring, and stop plate. Protractor must read 67° at this point. If necessary, slip the protractor face until it reads 67°. Lock protractor and stop plate in place.

2. Throttle Valve Roller Linkage (REF. L-7208-10)

2.1 Shim Bracket 560169 on peak valve piston such that "bellorank" lever 558961 has a 1:1 lever ratio.

2.2 Obtain dim. A (see Fig 2) prior to installation of peak valve.

2.3 Shim thickness = A - B - 2.00

2.4 Shim Bellcrank Lever to obtain .000 - .003 clearance with bracket connection on CDP rod. See Fig. #28,

3. Throttle Valve Multiplying Lever Pivot (REF. L-7208-10)

3.1 Shim the multiplying lever pivot bracket 558958 such that the distance from the centerline of the pivot to the centerline of the rollers 568339 is 1.335 when the peak valve is at 215 psia  $\pm$  K.

3.2 Set the multiplying lever at an angle of 30° by utilizing fixture 560000ET39 (See Fig.1). Position the peak valve to 215 psia  $\pm$  K. Zero out dial indicator. Install gage which locates rollers in respect to the centerline of the multiplying lever pivot. Adjust the peak valve position until the rollers are properly located. Determine amount and direction peak valve was moved. If adjusting screw was turned CCW (lower CDP) add this amount of shims from the multiplying lever pivot bracket. Subtract if C.W.

**Hamilton Standard**

DIVISION OF UNITED AIRCRAFT CORPORATION

WINDSOR LOCKS, CONNECTICUT • U.S.A.

**U  
A**

SPEC. NO. HS 1509 D

CODE IDENT. NO. 73030

PAGE 16 OF

4. Throttle Valve Roller Guide (Ref. L-7208-10)
  - 4.1 Shim position of throttle valve roller guide 558954 such that distance from bottom of roller carriage track to top of metering window in the throttle valve is  $3.880 \pm .001$  (see Fig. 3).
5. Throttle Valve Position Adjustment (Ref. L-7208-10)
  - 5.1 Assemble throttle valve less return springs in control. Position the throttle valve so that it is .010 from bottoming (minimum flow position).
  - 5.2 With throttle valve located as in 5.1 limit the travel of the position adjustment rod 558963 by shimming under spacer 560213 with shims 513029 such that  $A = B$ . (See Fig. 9)
6. Power Lever Servo Output Lever (Ref. L-7208-10)
  - 6.1 Install bracket 558966 on Servo Housing.
  - 6.2 Obtain Dim. B, and C as shown on Fig. 4.
  - 6.3 Shim between the Servo Housing and bracket 558966. Shim thickness =  $1.080 - (B + C)$ .
7. Peak Throttle Valve <sup>T</sup>T<sub>2</sub> Cam (Ref. L-7208-12)
  - 7.1 Determine the height to the centerline of the calibration cam follower A and to the centerline of control cam follower B from the parting line within .0005. (See Fig. 6)
  - 7.2 Calculate Dim. K (to be used in control calibration)
 
$$\text{Dim. K} = \text{Calib. Cam Follower } H_t - \text{Control Cam Follower } H_t / P .00615$$

Note: If Dim. K is minus, Dim. K must be subtracted from b settings specified in the control calibration.
  - 7.3 Measure the following as shown on Fig. 6
 

C: Height of upper metering window edge in sleeve (569511) from parting line

D: Metering edge of piston (558849) to upper end of piston

## HAMILTON STANDARD

SPEC. NO. HS 1509D

DIVISION OF UNITED AIRCRAFT CORPORATION

CODE IDENT NO. 73030

WINDSOR LOCKS, CONNECTICUT, U. S. A.

PAGE 17 OF

(cont'd)

- 7.3 E. From shim shoulder to spherical radius on guide 558853.  
F. From centerline of 30 psia detent on the cam 576075 to the shim shoulder on the cam.
- 7.4 Shim thickness =  $B - C + .184 - D - E - F$ .
- 7.5 Insert the cam shaft assembly in an arbor press in a vertical position. Apply a 30 lb. load to take the slop out of the pins. Measure the total shim thickness with a feeler gauge as shown in Fig. 6.
- 7.6 Install actual shim thickness between the 3-D cam and the cam shaft guide (558859).
- 7.7 Subtract the actual shim thickness from the total shim thickness and install these shims between the 3-D cam and the cam shaft collar (558857).
8. C.D.P. Sensor and Output Lever (Ref. L-7208-11)
- 8.1 On 561924 Assy determine amount of 560187 shims required to hold dimension "M" .000" - .005" above free position dimension.
- 8.2 Assemble the 561924 lever assembly and 560188 housing using the shims determined in Paragraph 8.1.
- 8.3 Install this assembly in fixture ET-560000-ET-43 Figure 5a. Adjust leveling screw until plane "A" defined on 561924 assembly drawing is parallel to plane "X" of fixture within .0005. Install Pin and Screw ass'y as shown in Fig. 5a. Tighten nut only until slack is out of Pin and Lever.  
Measure and record dimensions D1, D2, and D3.
- 8.4 Adjust fixture ET-560000-ET-43-1 Figure 5b to provide D2 dimension as determined in Paragraph 8.3. Place "locating rod" in pin groove at end of C.D.P. lever. Bolt flange and adjusting screw assembly to 560188 housing over the "locating rod" to maintain the D2 dimension.
- 8.5 Measure and record width dimension (W<sub>L</sub>) of C.D.P. lever at the nozzle metering location (see Figure 5b).
- 8.6 Install 558901 nozzles in servo housing without any shims. Using gage blocks, measure and record dimension (D<sub>n</sub>) between nozzles (see Figure 5c).
- 8.7 Using formula,  $T_{shim} = (W_L + .010) - D_n$ , determine the total shim thickness (see Figures 5a and 5c).
- 8.8 Remove one of the 558901 nozzles. Measure and record dimension L<sub>1</sub> (see Figure 5d) back off, but do not remove opposite nozzle.
- 8.9 Attach assembly (ref. Paragraphs 8.2 and 8.4) to servo housing, use seal #69397A29. Apply approximately a 10 lb. load at radius "D" (ref. drawing 561924) of C.D.P. lever. (See Figure 5d)

## HAMILTON STANDARD

SPEC. NO. HS 1509D

DIVISION OF UNITED AIRCRAFT CORPORATION

CODE IDENT NO. 73030

WINDSOR LOCKS, CONNECTICUT, U. S. A.

PAGE 18 OF

- 8.10 Measure and record dimension  $L_2$  in the nozzle housing. (See Figure 5d) Determine shim thickness required for this nozzle using formula  $T_{shim} = (L_1 + .005) - L_2$ .
- Remove this shim thickness from total established in Paragraph 8.7, and re-assemble with nozzle. Remove and reassemble opposite nozzle with the shim thickness remaining from total  $T_{shim}$ .
- 8.11 Remove lever assembly from servo housing and 560188 housing.
- 8.12 Assemble the motor bellows portion of sensing bellows set 553139 and adjusting screw 553138. Apply a net load of 2.0 lbs. as shown in Figure 5e, and set dimension  $(D_2 + .010 \pm .005)$  (ref. Paragraph 8.3). Pin 553137 must be aligned with one side of bellows flange. (See Figure 5e). Mark position of adjusting screw and bellows nut with pencil or crayon to insure proper alignment of final assembly. Use fixture ET-560000-ET-44.
- 8.13 Attach the evacuated bellows portion of sensing bellows set 553139 to above assembly (ref. Paragraph 8.12). Apply a 6.2 lbs. load as shown in Figure 5e, and set dimension  $D_1 = D_2$  (ref. Paragraph 8.3). Mark position of adjusting screw and nut. (ref. Paragraph 8.12). Use fixture ET-560000-ET-44.
- 8.14 Install adjusted bellows sensing set (ref. Paragraph 8.12 and 8.13) into 560188 housing. Pin 553137 must be parallel to servo housing mounting surface.
- Cautions: Do not rotate evacuated bellows when bellows are being tightened down in housing. Measure and record dimensions  $C_2$  and  $C_3$  as shown in Figure 5f, using fixture ET-560000-ET-43-2. Determine dimension  $C_1$  using formula  $C_1 = C_3 - C_2$ .
- 8.15 Determine shim thickness for "M" dimension as shown in Figure 5a, (ref. Paragraph 8.3) using formula  $T_{shim} = D_3 - C_1$ .
- Note: Add  $T_{shim}$  to original shim valve if  $D_3$  is larger than  $C_1$ .
- Remove  $T_{shim}$  from the original shim valve if  $D_3$  is smaller than  $C_1$ .
- 8.16 Attach 561924 lever and bracket to bellows sensing set and housing assembly (ref. Paragraph 8.14) using  $T_{shim}$  thickness determined in Paragraph 8.15.
- 8.17 Attach this assembly (ref. Paragraph 8.16) to servo housing.
- 8.18 Install CDP & Throttle Valve Transfer System Linkages.
- 8.18.1 Center CDP & T.V. Roller Push Rod Assemblies so that the center roller bearings do not interfere with the balance bar groove. Maintaining the bearings in this position, determine the shims required in the areas shown on Figures 32 & 33.

WINDSOR LOCKS, CONNECTICUT, U. S. A.

PAGE 19 OF

- 8.18.2 After shimming has been completed, move linkages to maximum end play position. Center roller bearing in either push rod assembly (CDP & T. V.) must not touch walls of balance bar groove over the full length travel on the balance bar.
9. Temperature T2 Washout Link (Ref. L-7208-14)
- 9.1 Obtain the dimension A from the Tt2 mounting face to the centerline of pin 69725-3036 in bracket 560013. (See Fig. 8).
- 9.2 With the power lever cam at its maximum radius obtain Dimension B, Tt2 housing mounting surface to the centerline of pin 69538A9-6 in lever 560024.
- 9.3 Shim between bracket 560013 and bracket 560028 with shims 560284.
- 9.4 Shim thickness =  $A - B$ .
10. Compressor bleed shift linkage (L-7208-13)
- 10.1 Assemble linkage as shown on fig. 7.
- 10.2 Set the multiplying lever parallel to the parting line of the servo hsg.
- 10.3 Obtain dimension A and from para. 8.10 HS-1509 fig. 5d obtain dimension B.
- 10.4 Shim thickness is  $S = A - B$ .  
Place shims in location shown on figure 7.
- 10.5 Position CBA rollers at  $1.625 \pm .005$  as shown on figure 26.
11. Pressure Regulating Valve Sensor - Peak and Inline (Ref. L-7208-116)
- 11.1 With the flapper system assembled outside the sensor housing.  
Determine dimensions A, B, and C with the flapper closed as shown in Fig 14.
- 11.2 Shim under pin-ball 558869 with shims 515298.
- 11.3 Shim thickness  $A - (B + C) + .015$ .
12. Manifold Transfer System (L-7208-23)
- 12.1 Install 560000 Et-23 across hydraulic housing with 70 lb. force directed to the balance bar, locating the force balance bar (572547) in a horizontal position. With the balance bar in a horizontal position shim both nozzles to a .008 - .010 gap. See Fig. 10.
- 12.2 Install 560000 Et-24 across the hydraulic housing. Maintain the force balance bar (572547) in a horizontal position by installing .008 - .010 shim stock between nozzles and the force balance bar.
- 12.3 Utilizing 560000 ET-24 locate the centerline of the C.D.F. rollers .412 ± .002 from the centerline of pivot pin 579488 with the peak valve located at 30 psia ± K. With the rollers .750 from E of pivot pin shim under bracket 560082 with shims 560098 until distance from the centerline of pin 69725-30-14 on CDP rollers is .205 ± .005 above the roller contact surface on the force balance bar.



**Hamilton Standard**

DIVISION OF UNITED AIRCRAFT CORPORATION

WINDSOR LOCKS, CONNECTICUT • U.S.A.

U  
A

SPEC. NO. HS 1509 D

CODE IDENT. NO. 73030

PAGE 20 OF

- 12.4 Utilizing 560000 ET-24 locate the centerline of the T.V. rollers  $.358 \pm .002$  from the centerline of pivot pin 579488 with the throttle valve set for a  $.014$  window opening. See Figure 22. With the rollers  $.690$  from  $\phi$  of pivot, shim under bracket 576473 with shims 560099 until distance from centerline of pin 579488 on the throttle valve rollers is  $.208 \pm .005$  above the roller contact surface on the force balance bar. (See Fig. 11)
- 12.5 Shim under bracket 560088 with shims 560097 so links 560086 and 560013 will not dis-engage under extreme travel conditions. (See Figure 12)
- 12.6 Assembly transfer housing less power springs, adjusting screws and transfer valve, obtain dimension A from transfer housing face to L of power lever pin. (See Fig. 19).
- 12.6.1 With transfer linkage assembled in hydraulic housing obtain the Dimension "B" from the top of the rollers to the hydraulic housing mounting face. (Fig. 19). Shim under bracket 572553 and 572554 with shims 577935. Shim thickness = A-B.
- 13.0 Zone I Shut-Off Valve
- 13.1 Shimming Procedure
- 13.1.1 Obtain Dimension A on cap 558904 (See Fig. 18).
- 13.1.2 Install packing 69587A58, chevron 69588-58, ring 69586A58, and spacer 576445 into the housing as shown. With valve and seal held firmly against the bottom of the housing obtain readings at  $90^\circ$  intervals on the spacer. The readings should not vary more than  $.004$ .
- 13.1.3 The average reading is dimension B.
- 13.1.4 Shim between spacer and back-up ring (See Fig. 18). Shim thickness S = B-A ( $.002$  to  $.004$ ).
- 13.2 Springheight adjustment; ref. Sect. A-A, 573184.
- 13.2.1 Assemble the spring and retainer sub-assembly with nut 69765-3, in approximately correct position.
- 13.2.2 Install the sub-assembly (13.2.1) into the valve I.D.
- 13.2.3 Place cover 558904 on top of the outboard retainer. Push in lightly on cover to be sure that the valve is seated.
- 13.2.4 Measure the distance between the housing and the cover bolt flanges.
- 13.2.5 Adjust nut, 69765-3, until the distance (13.2.4) is  $.125 \pm .020$ .
- 13.2.6 Complete assembly in accordance with the picture shown on Sect. A-A of 573184.

**Hamilton Standard**

WINDSOR LOCKS, CONNECTICUT • U.S.A.

DIVISION OF UNITED AIRCRAFT CORPORATION

U  
A

SPEC. NO. HS 1509 D

CODE IDENT. NO. -73030

PAGE 21 OF

**14. Temperature Servo Piston Roller Position**

14.1 Obtain dimension from the temperature servo piston cap mounting surface on the linkage housing to the centerline of peak throttle valve bore. (Dimension B, See Fig. 13).

14.2 Install the temperature servo piston and 560000 Et-21, and 560000 Et-7. Position The servo piston until it is at -65°F. as indicated by the cam follower (560000 ET-7). With the piston held in this position obtain Dimension X.

14.3 Position rollers on the servo piston such that Dim. A = B - X - .745.

**15. Temperature Servo**

15.1 With levers 562050 and 562059 in line as shown on Fig. 15. Hold lever 560136 parallel to 562059 and shim under bracket 560138 until distance between 562059 and 560136 is .501 ± .001.

15.2 With levers held as in 15.1 shim nozzles 560129 for a .003 gap on each nozzle.

15.3 Shim under bellows assembly 574153 with shim 562054. Shim thickness (X + D - .130) - A ± .001. See Fig. 16 and 17.

15.4 Adjust stop screw 562055 until Dim. C = F - .300. See Fig. 17.

**15.5 Final Stop Screw Adjustment.**

15.5.1 Using a spring tester, determine the load at which the sensor's motor bellows reaches a null position (approx. 70-75 lbs.). See Fig. 29.

15.5.2 Install roller simulator between reduction and feedback levers. Install sensor with motor bellows (seal 69400A57 not to be used) in spring tester and apply null load. Position roller simulator until flapper is in null position between nozzles. See Fig. 30.

15.5.3 If a flapper null position cannot be attained, reset the set screw, 562055,  $\frac{1}{4}$  turn CW or more and repeat 15.5.2.

15.5.4 If a flapper null position is attained, use shim stock to measure clearance between motor diaphragm and housing (dim. N).

15.5.5 Referring to Fig. 17, reduce "C" dim. by the amount of dim. N found in 15.5.4 so that motor diaphragm and hsg. are line on line in the loaded conditions.

16. Pump Control Piston (Ref. L-7208-112)
- 16.1 Shim under rack to position the pitch line on the centerline of the piston. See Fig. 23.
- 16.2 Obtain dim. A. O. D. of piston.
- 16.3 Position the lower piston rack until it is parallel to a referenced surface plate and obtain dim. B. using a .1150 dia. wire.
- 16.4 Shim under the rack with proper shims. Shim thickness =  $(\frac{A}{2} + .068) - B \pm .001$
17. Zone II Shut-Off Valve and Peak Regulator Valve
- 17.1 Installation of Shim (See Fig. #24)
- 17.1.1 Obtain dimension "A" on cover 576441.
- 17.1.2 Assemble matched set 576447. (There is no shimming for recirculation or shut-off valves. Assemble them per drawing 573185 and para. 17.2)
- 17.1.3 Install packing 576396, seal 69588-56 and ring 576395 into housing. Obtain dimension "B" by taking readings at 90° intervals. These should not vary more than .004.
- 17.1.4 The average of these readings is dimension "B".
- 17.1.5 Shim below packing 576396 (See Fig. 24). Shim thickness is  $S = B - A - (.002 \text{ to } .004)$ .
- 17.1.6 Repeat 17.1.3 as a check of proper installation.
- 17.2 Spring height adjustment (Ref. Sect. A-A, drawing 573185).
- 17.2.1 Assemble the spring and retainer sub assembly (includes spacer 576437) with the nut, 69765-3, in approximately the correct position.
- 17.2.2 Install the shut-off valve into housing as in Sect. A-A, drawing 573185.
- 17.2.3 Install the sub-assembly (17.2.1) into the valve I.D.
- 17.2.4 Place cover 576438 on top of the outboard retainer. Press lightly on cover to be sure that the valve is seated.
- 17.2.5 Measure the distance between the housing and the cover bolt flanges.
- 17.2.6 Adjust nut, 69765-3, until the distance (17.2.5) is  $.125 \pm .020$ .
- 17.2.7 Complete assembly in accordance with the picture shown on Sect. A-A of 573185.
18. Peak Valve Sleeve and Chevrans
- 18.1 Assemble seals, retainers, and spacer on peak valve sleeve and install sleeve in cover. Slide spacer and seals tight against sleeve stop and measure gap between spacer and cover. See Fig. 27.
- 18.2 From measurement obtained in 18.1 subtract .003 and add this amount of shims between spacer and cover.
- 18.3 Check end play after shimming. It must be between .002 - .004.

HSF-753.1A 5/61

## HAMILTON STANDARD

SPEC. NO. HS 15090 D

DIVISION OF UNITED AIRCRAFT CORPORATION

CODE IDENT NO. 73030

WINDSOR LOCKS, CONNECTICUT, U. S. A.

PAGE 23 OF

APPENDIX C

<u>PART NAME</u>	<u>LENGTH OF STROKE</u>
1. Peak Throttle Valve	1.5 Min from bottomed position
2. Cam Shaft & Ends With Piston Ring	1.5 Min from top of bore
3. Pump Control	
a. Main Piston	1.4 Min from bottomed position
b. Intermediate Piston	.3 Min from top of housing
c. Pilot Valve	.4 Min from bottomed position
4. Throttle Operated Pilot Valve	
5. Transfer System	
a. Piston (InL&H Hsg.)	.5 Min from bottomed position
b. Transfer Valve	.5 Min from bottomed position
6. PL Serve Pilot Valve	.5 Min from stop-pin
7. PL Serve Piston (with Piston Rings)	.9 Min from bottomed position
8. Time Delay Valve	.3 Min from bottomed position
9. Speed Signal Valve (Upper & Lower)	.4 Min from bottomed position
10. PRV Sensor and Peak Sensor	.25 Min from top of sleeve
11. Inline PRV	.4 Min from bottomed position
12. Main T.V. (Install in Hsg. with Cover)	Stop to Stop
13. Zone I SOV	.4 Min from window end of sleeve
14. Zone II Valves	
a. Recirculation	.4 Min from window end of sleeve
b. PRV & SOV	.4 Min from window end of sleeve
c. Ref. Valve	.4 Min from top of sleeve
15. Tt2 Piston (With Piston Rings)	From Piston Ring Chamfer to Bottomed Position

DIVISION OF UNITED AIRCRAFT CORPORATION

CODE IDENT NO. 73030

WINDSOR LOCKS, CONNECTICUT, U. S. A.

PAGE 24 OF

Appendix H

	(PSIA) PB	Conditions	Total PPH Wf Limits	PPH Peak Wf Limits
1)	60 150	(Tt2 = -65°F B.C.) PLA = 120°	22300-24700 54800-60600	13100-14500 32700-36300
2)	40 200	(Tt2 = -65°F B.C.) PLA = 68°	3230-3570 16150-17850	
3)	30 150	Transfer per para. 14.5.2	7920-8760 39600-43800	
4)	18 150	(Tt2 = 150°F B.C.) PLA = 120°	5560-6160 46400-51400	

FIGURE 1

Spec. No. HSL509D  
Page 25 of —

# L-7208-10 T.V. ROLLER LINKAGE SHIMMING PROCEDURE

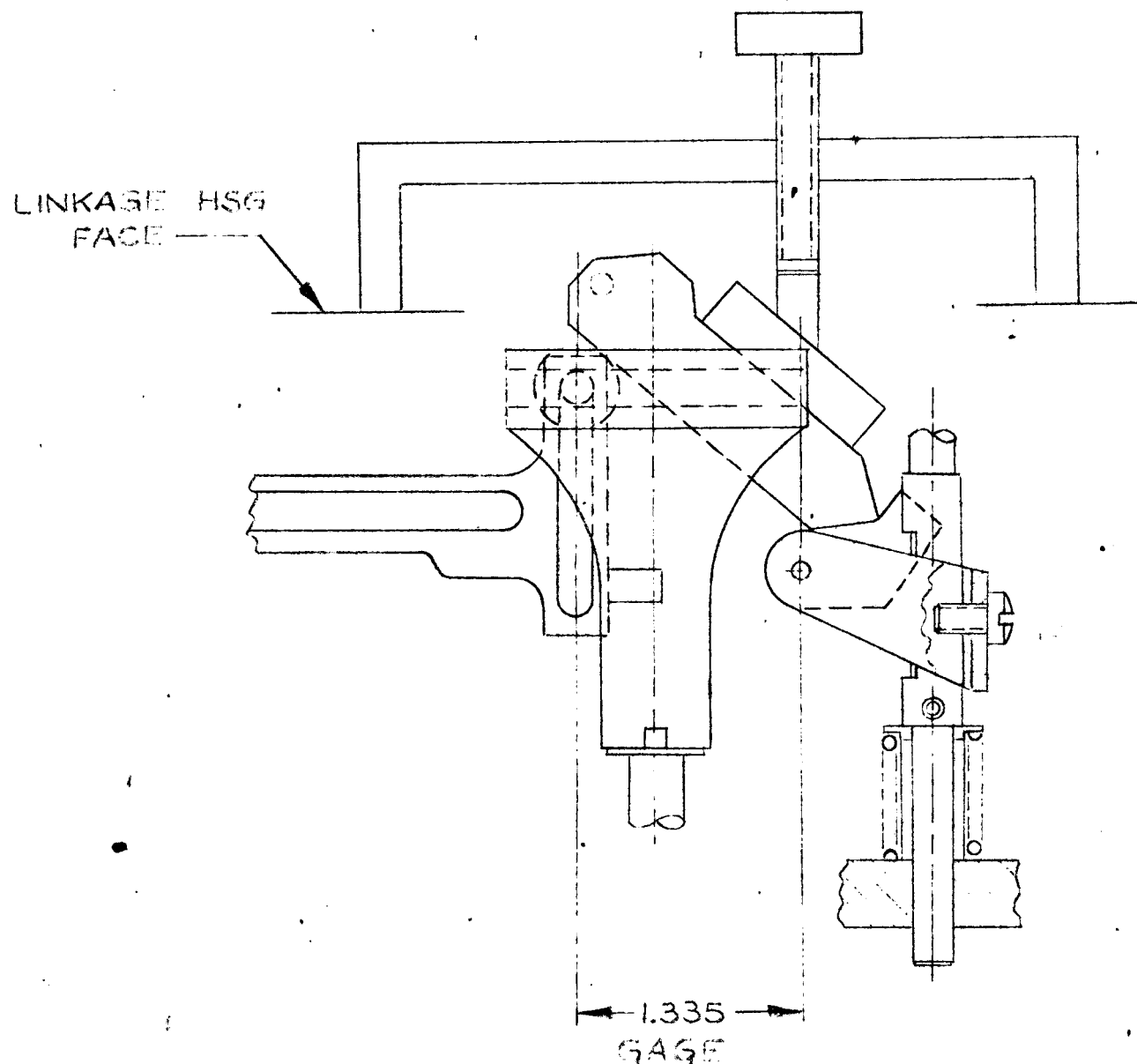


FIGURE 1

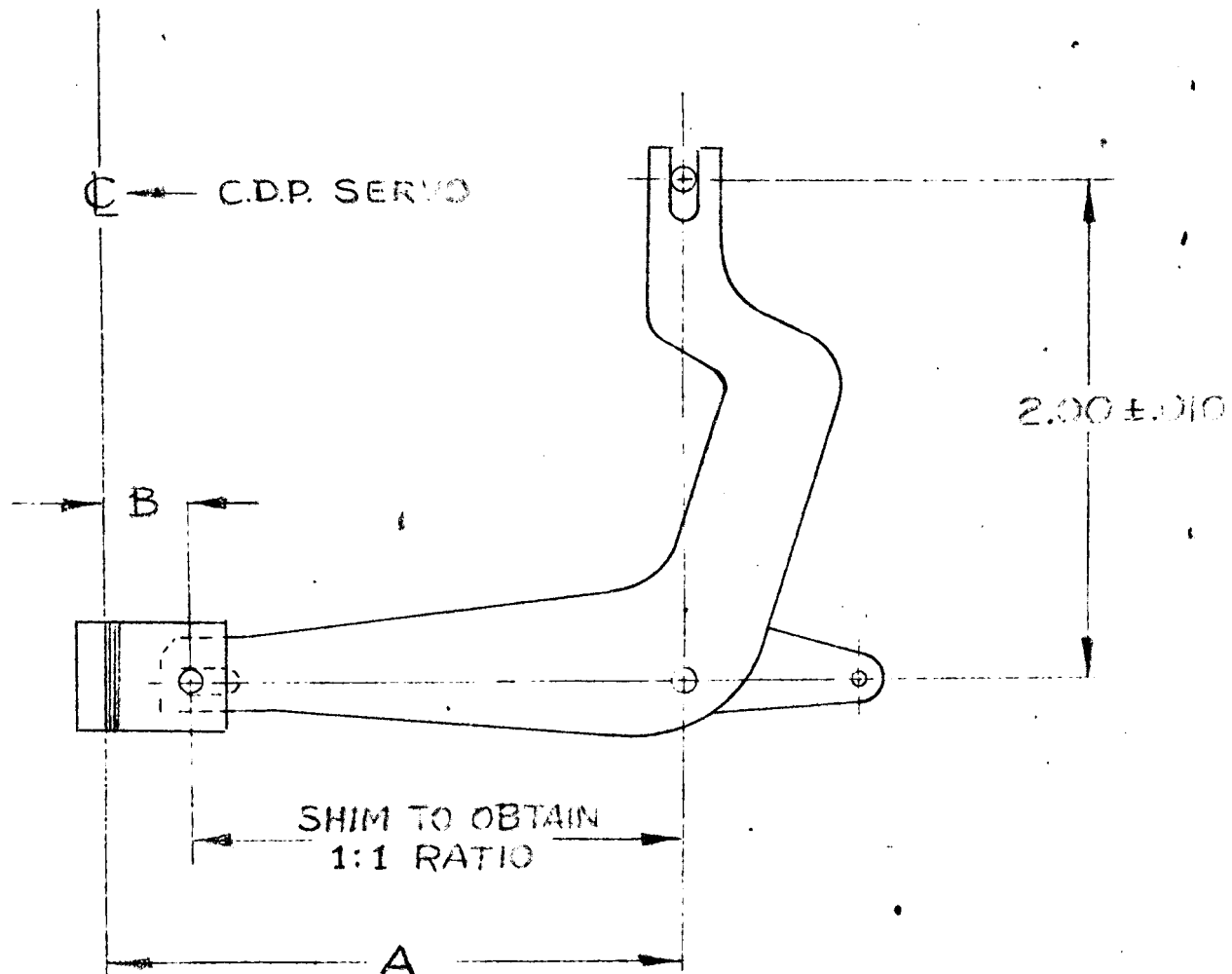
FIGURE 2

Spec. No. HS1509 D

Page 26 of —

# L-7208-10 T.V. ROLLER LINKAGE

SHIM TO OBTAIN 1:1 RATIO



$$\text{SHIM THICKNESS} = A - B - 2.00$$

USE 2.00" RATHER THAN MEASURING ACTUAL 2.00 ± .010 DIM.; ERROR IN LEVER RATIO WILL BE INSIGNIFICANT. INSTEAD OF 1:1 RATIO WILL BE 1:1.01

FIGURE 2

L-7208-10 T.V. LINKAGE

FIGURE 3

Spec. No. HS 1509 D  
Page 27 of —  
CODE 73030

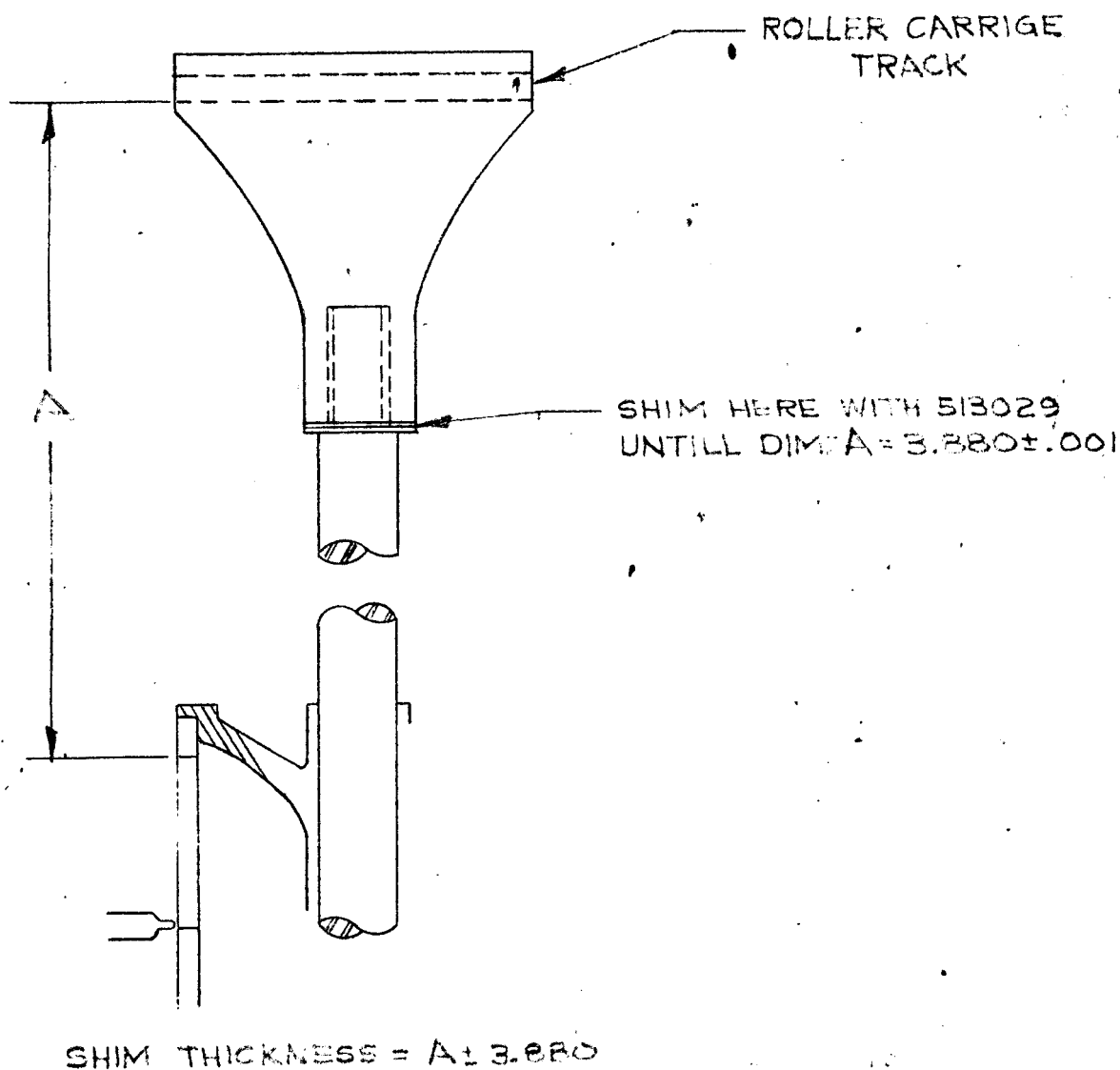


FIGURE 3



FIGURE 4

Spec. No. HS 1509 D  
Page 28 of —  
CODE 73030

# L-7208-10 T.V. ROLLER LINKAGE

(SET CORRECT RATE BETWEEN  
P.L. SERVO & T.V. MULTIPLYING

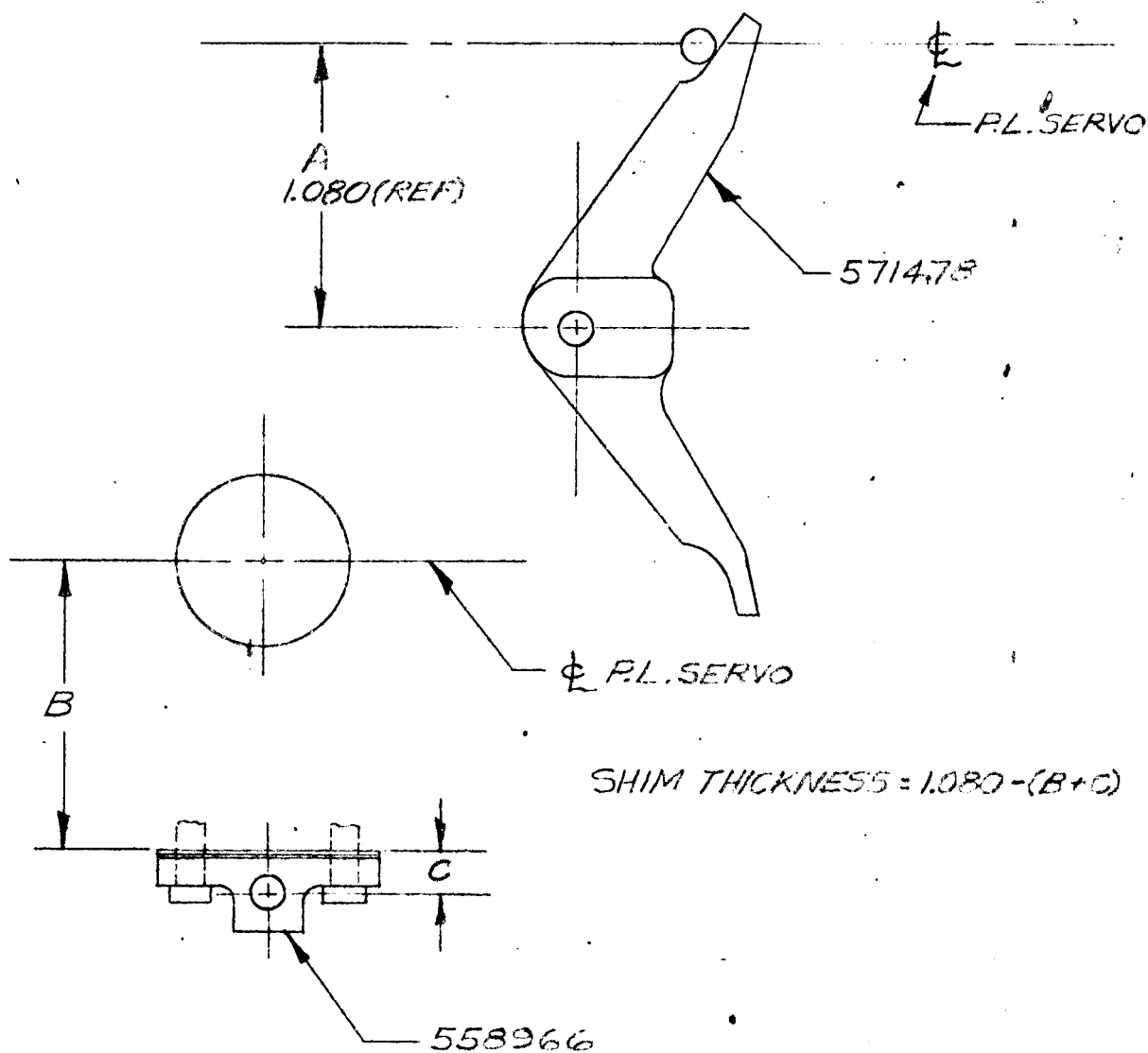


FIGURE 4

HAMILTON STANDARD

PLANE A DEFINED ON  
561924 TO BE PARALLEL  
TO THIS PLANE  
WITHIN .0005

APPROX 21.5  
STUDIOS FOR

15.0000  
SCREW

$90 \pm 0.3$

SHIM  
DIM.

ET-560000-ET-45

PLANE 'X'

MIN 4.0000 4.551

FIG-5a

HAMILTON STANDARD

CAUTION:

PIVOT PIN MUST BE  
PARALLEL TO ONE SIDE OF  
FLANGESET  $\rightarrow D_2$ 

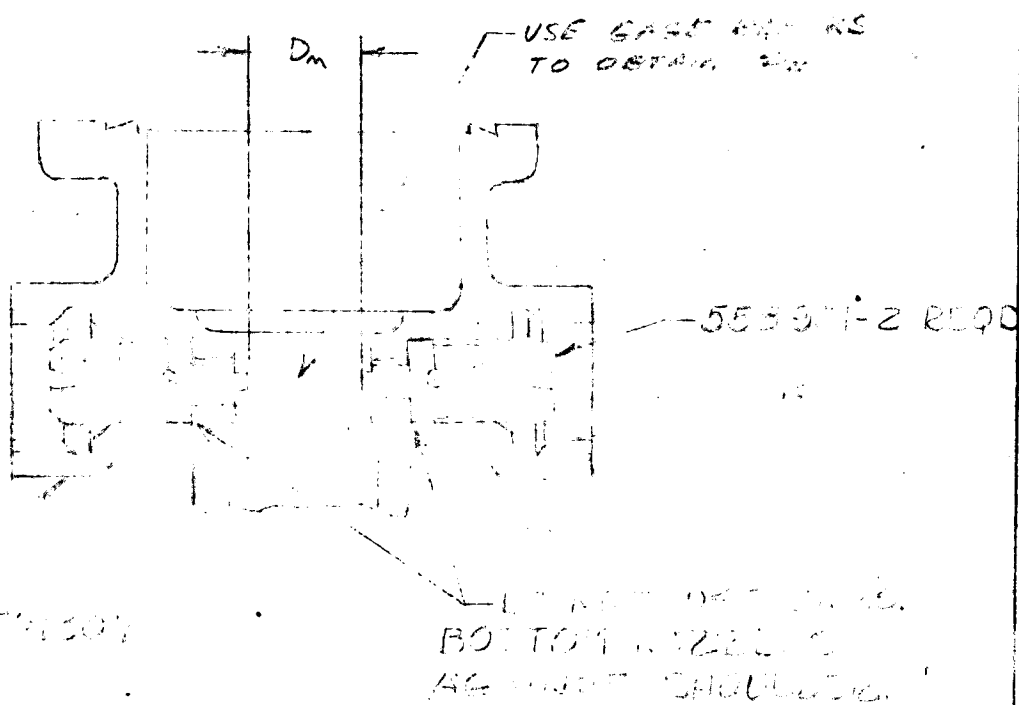
- [ ] - 560188 - EC 45-1

FLANGE WITH ADJUSTING  
SCREW ASSEMBLY  
USE 3 SCREWS TO  
HOLD DOWN

560188

FIG-51

HAMILTON STANDARD



20000)  $T_{\text{burn}} = (W_k - 0.10) - D_m$

FIG - 5c

HAMILTON STANDARD

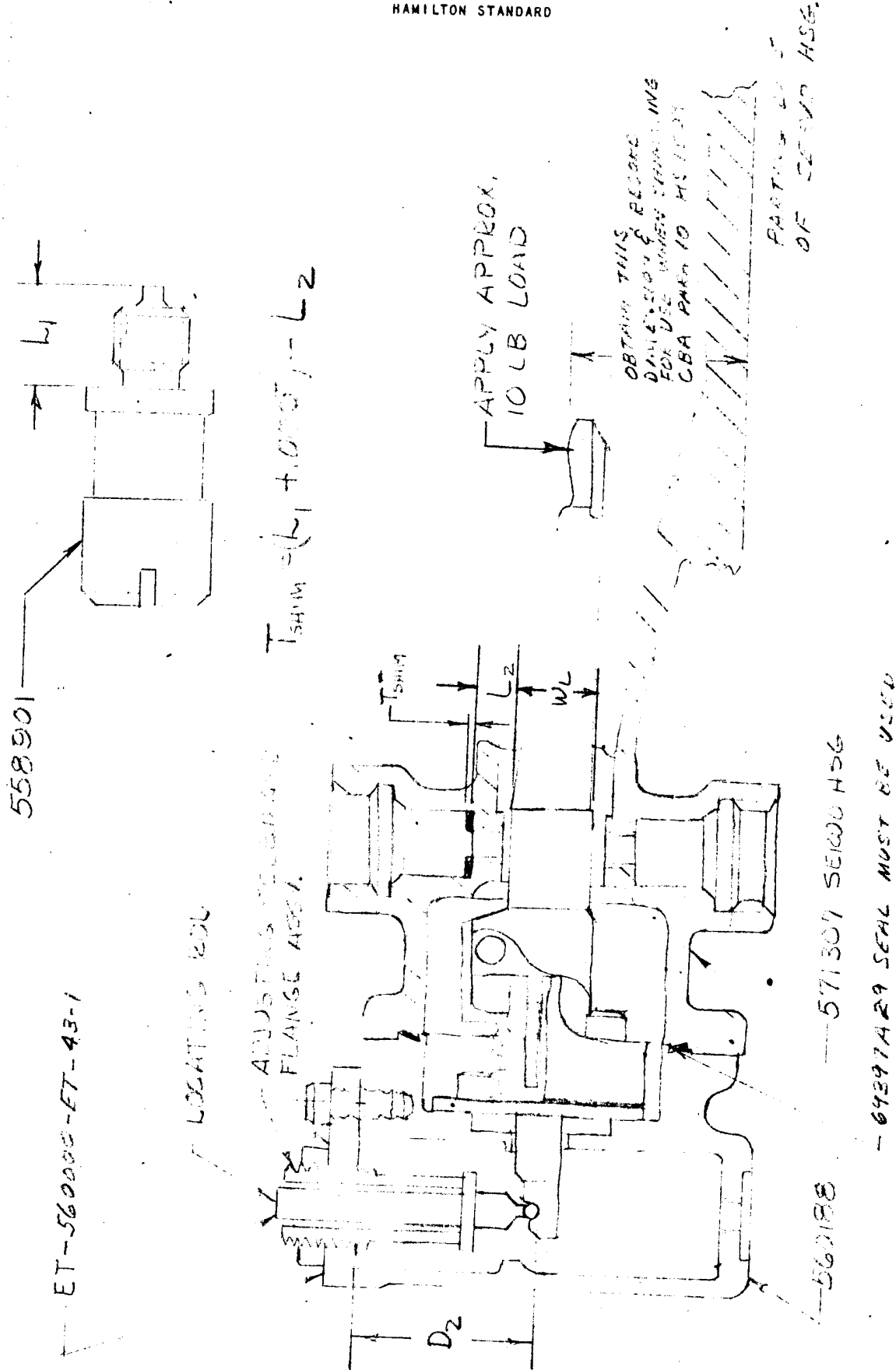


FIG. -52

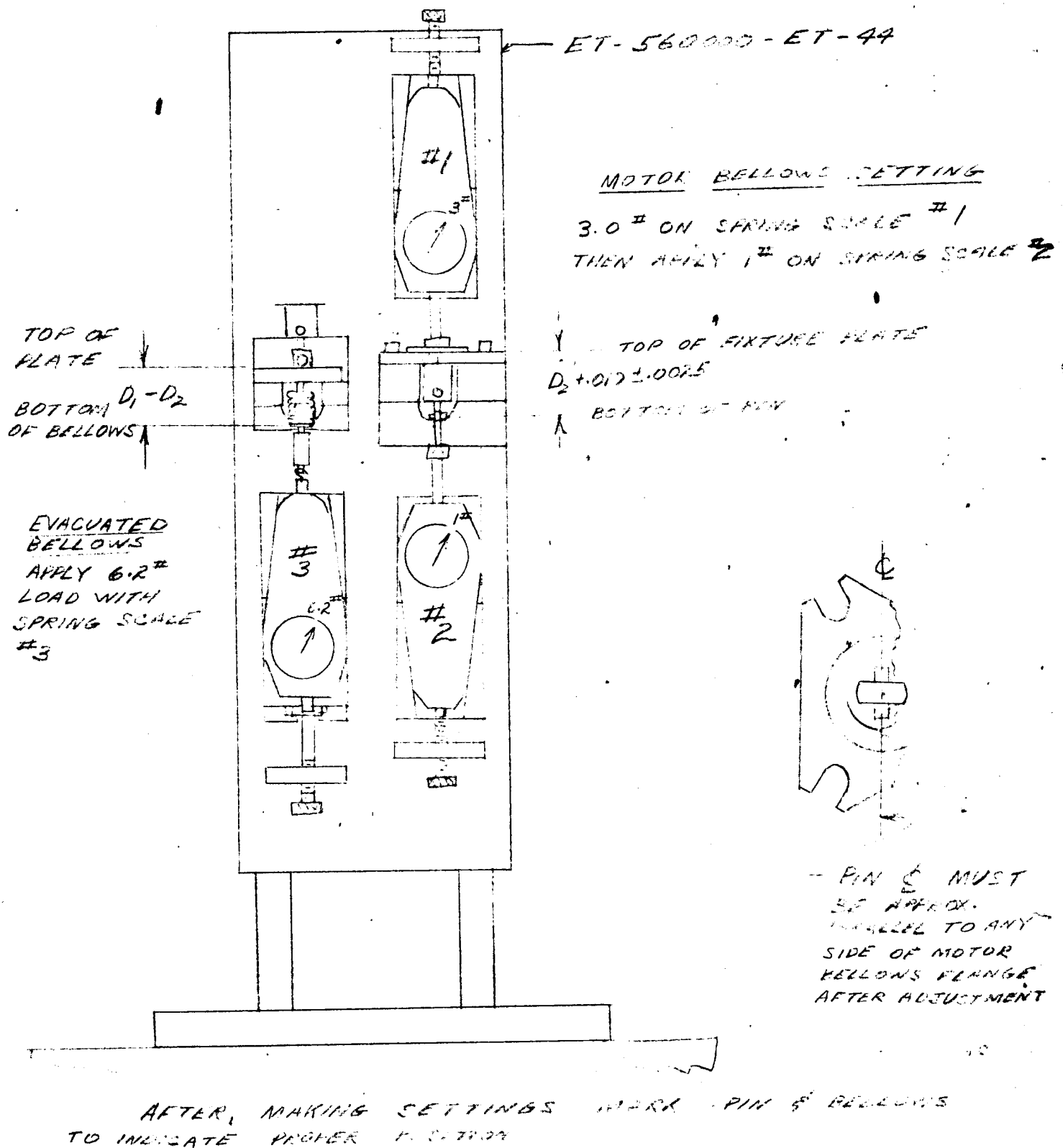
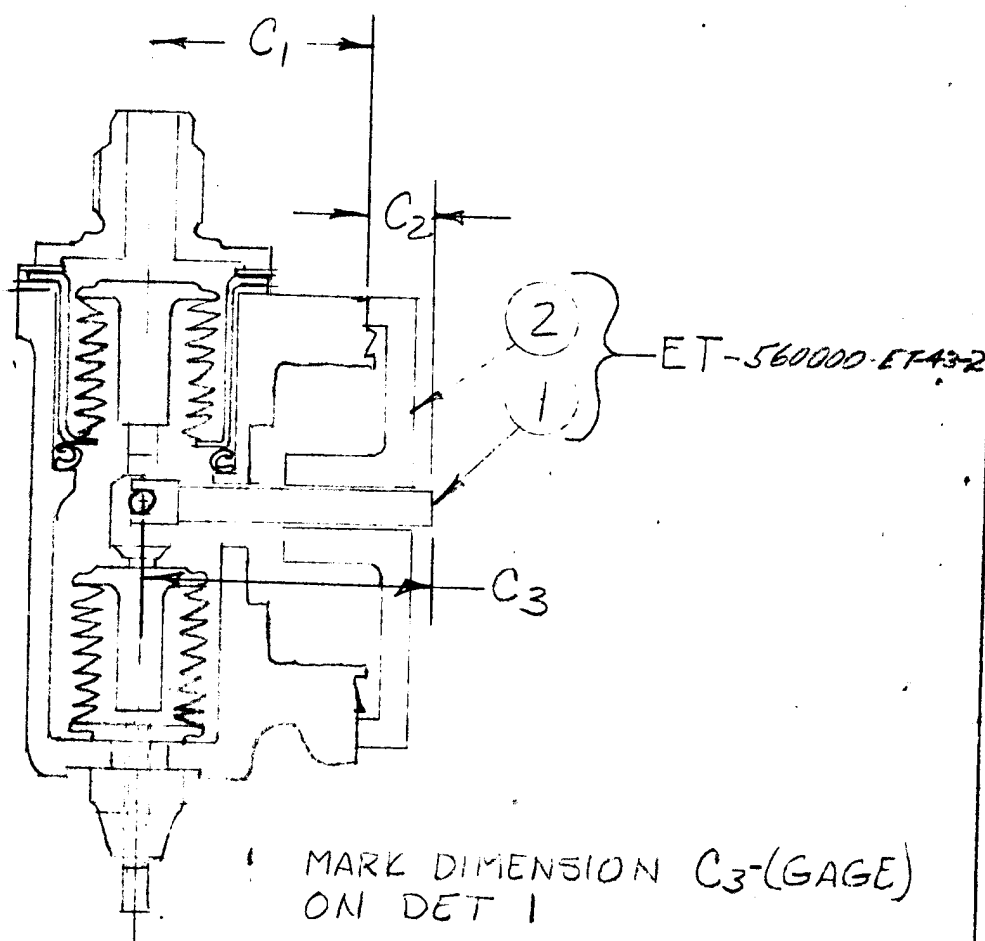
H.S. Spec. 1509D  
Pg. 33 of

FIG-5e

HAMILTON STANDARD



$$C_1 = C_3 - C_2$$

FIG. -5f

Spec. No. HS 1509 D -

Page 35 of

CODE 73030

FIGURE 6

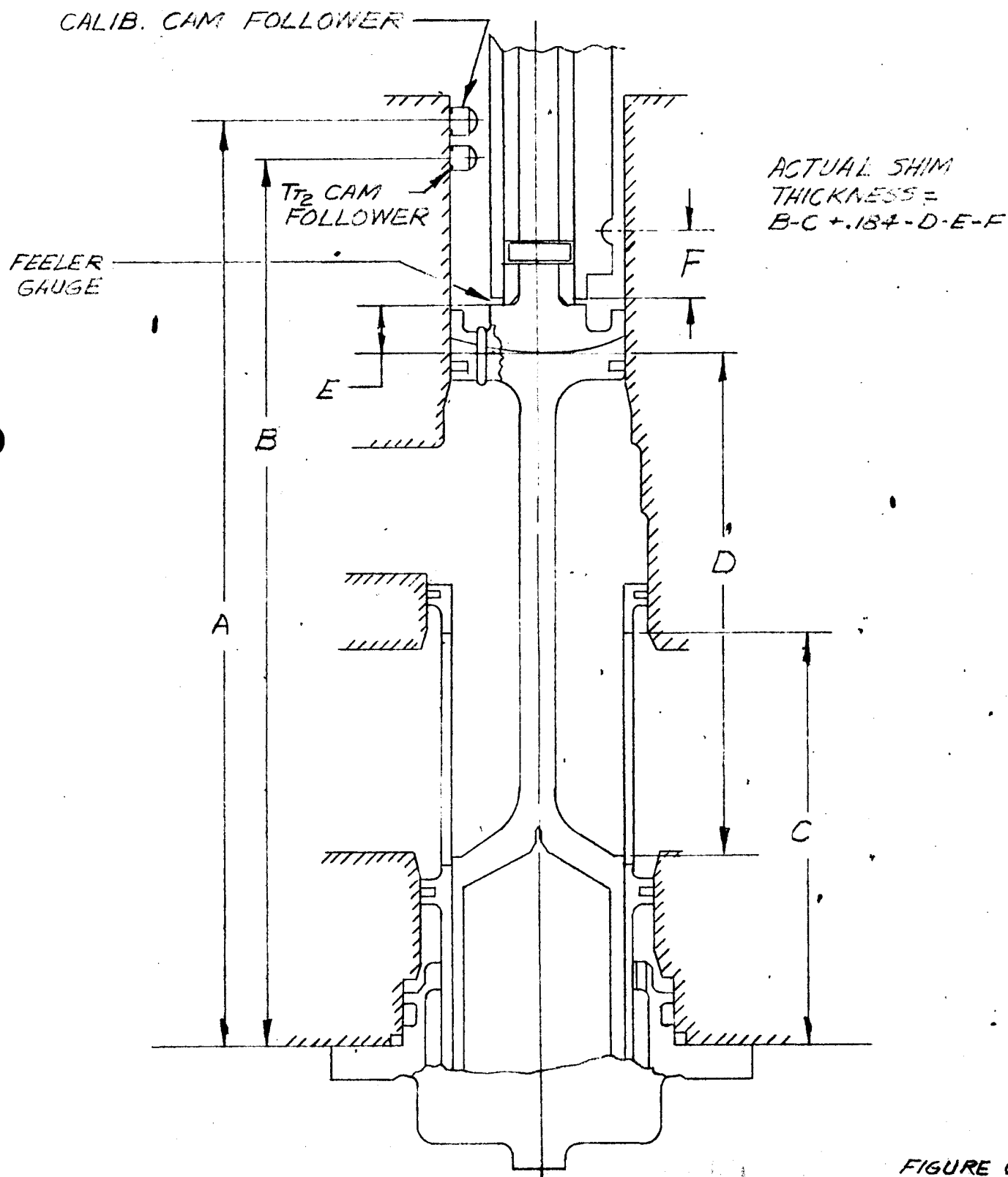


FIGURE 6

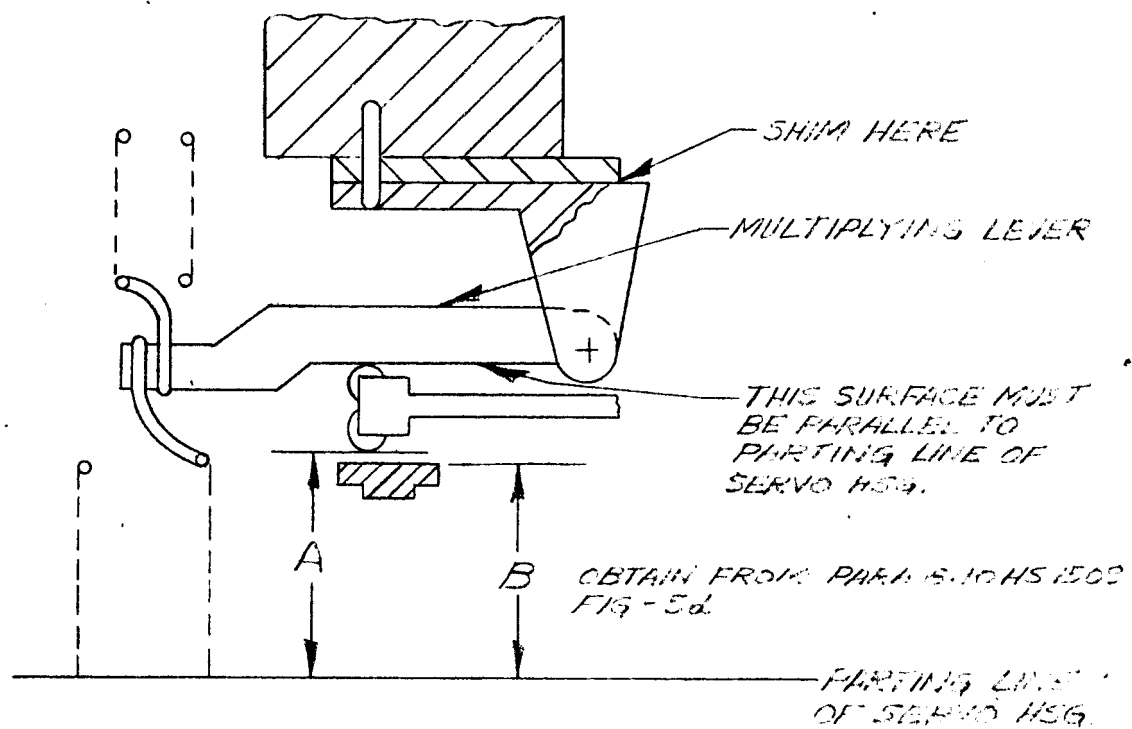


H.S. Spec. 1509 D

Page 36 of —

Code 73030 —

L-7203-13 C.B.A. LINKAGE



SHIM A-E

REV. 3-30-62

FIG-7

HS F-755.1B 6/62

**Hamilton Standard**

WINDSOR LOCKS, CONNECTICUT • U.S.A.

DIVISION OF UNITED AIRCRAFT CORPORATION

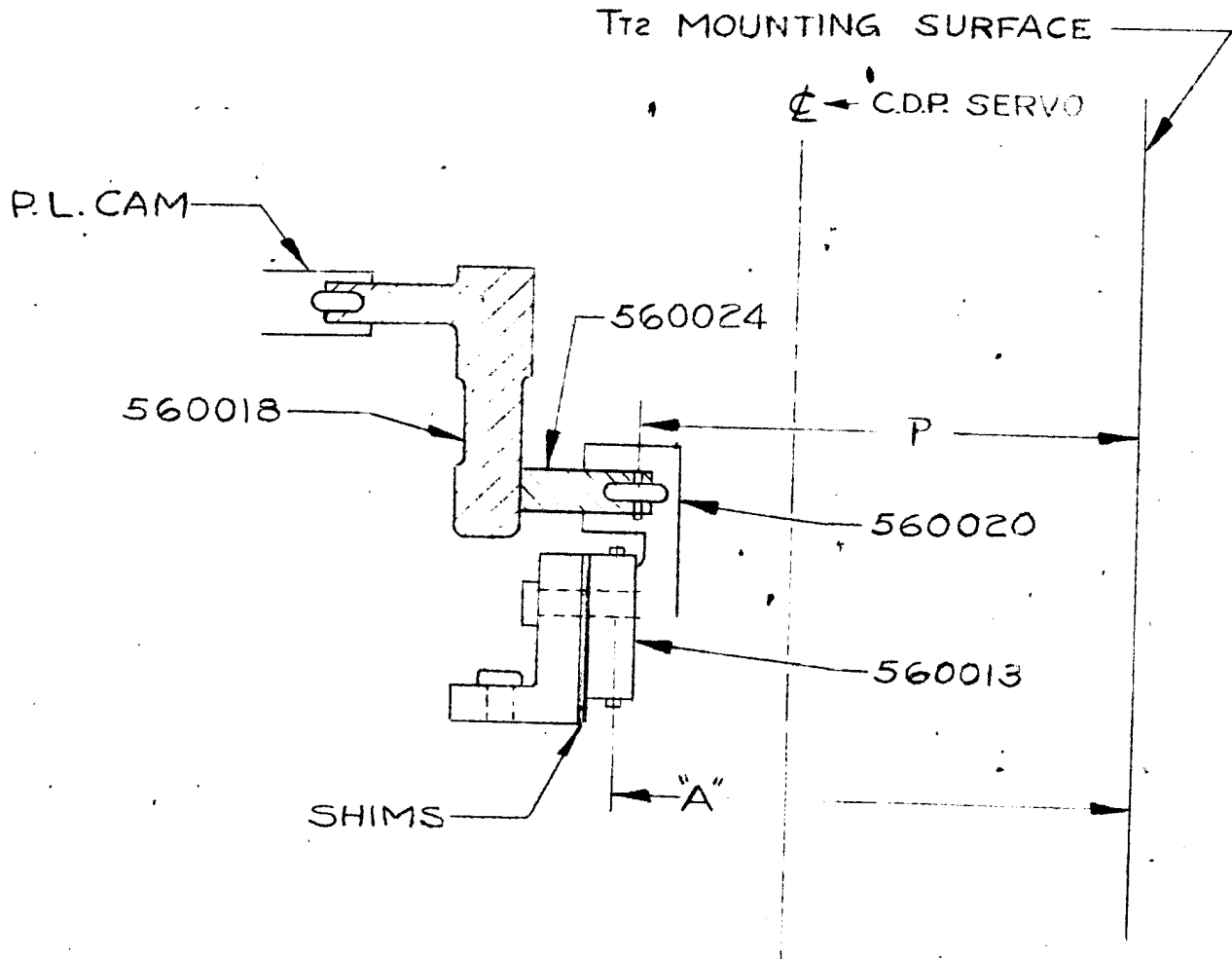
**U  
A**

SPEC. NO. HS 1509 D

CODE IDENT. NO. 73030

PAGE 37 OF

L-7208-14 P. L. LINKAGE



POWER LEVER CAM TO BE AT MAX. RAD  
 WHEN MEASURING DIM. "B"  
 SHIM THICKNESS = A-B

FIGURE 8

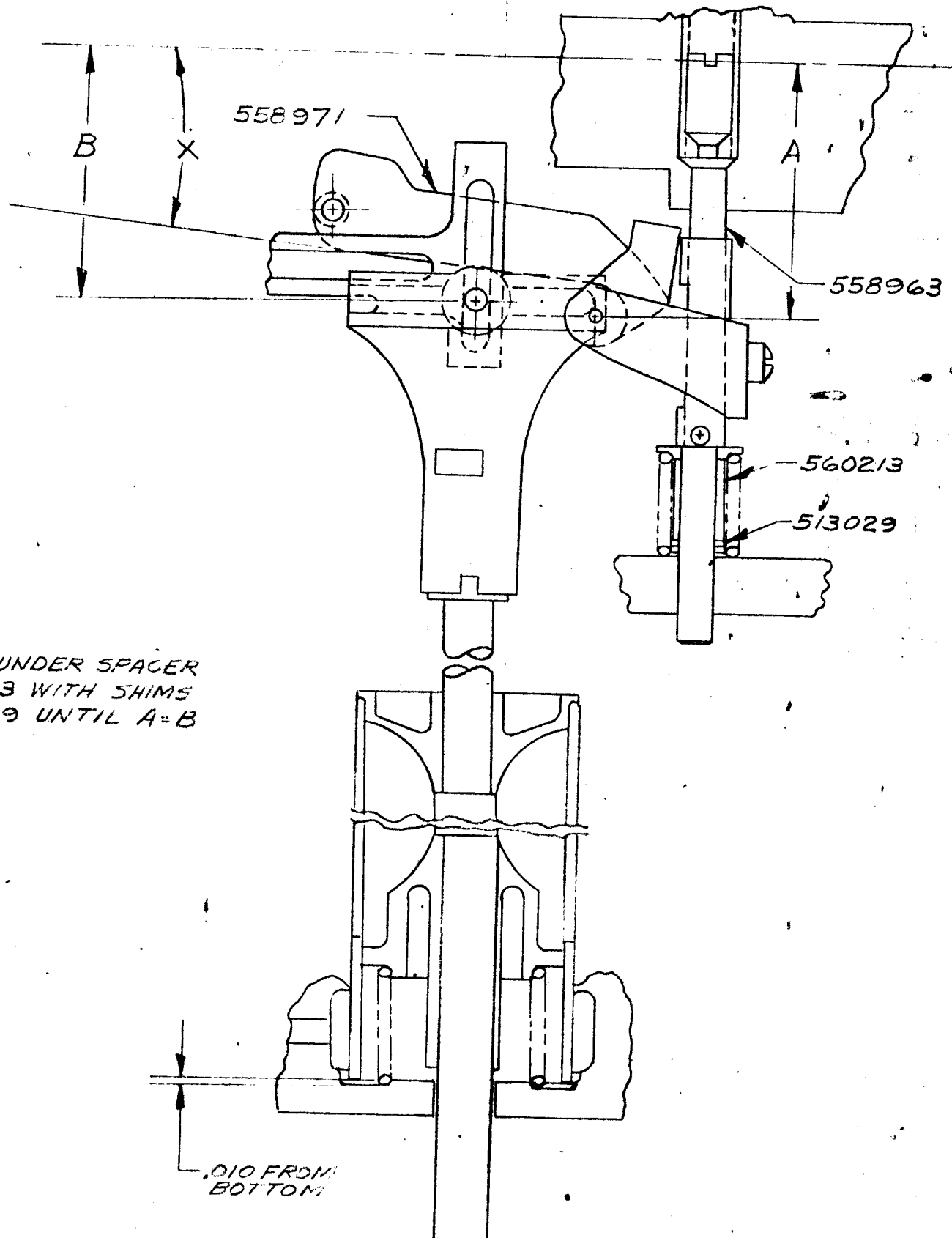
FIG 9

# THROTTLE VALVE LINKAGE

CODE 73030

Spec. No. HS 1509 D

Page 38 of

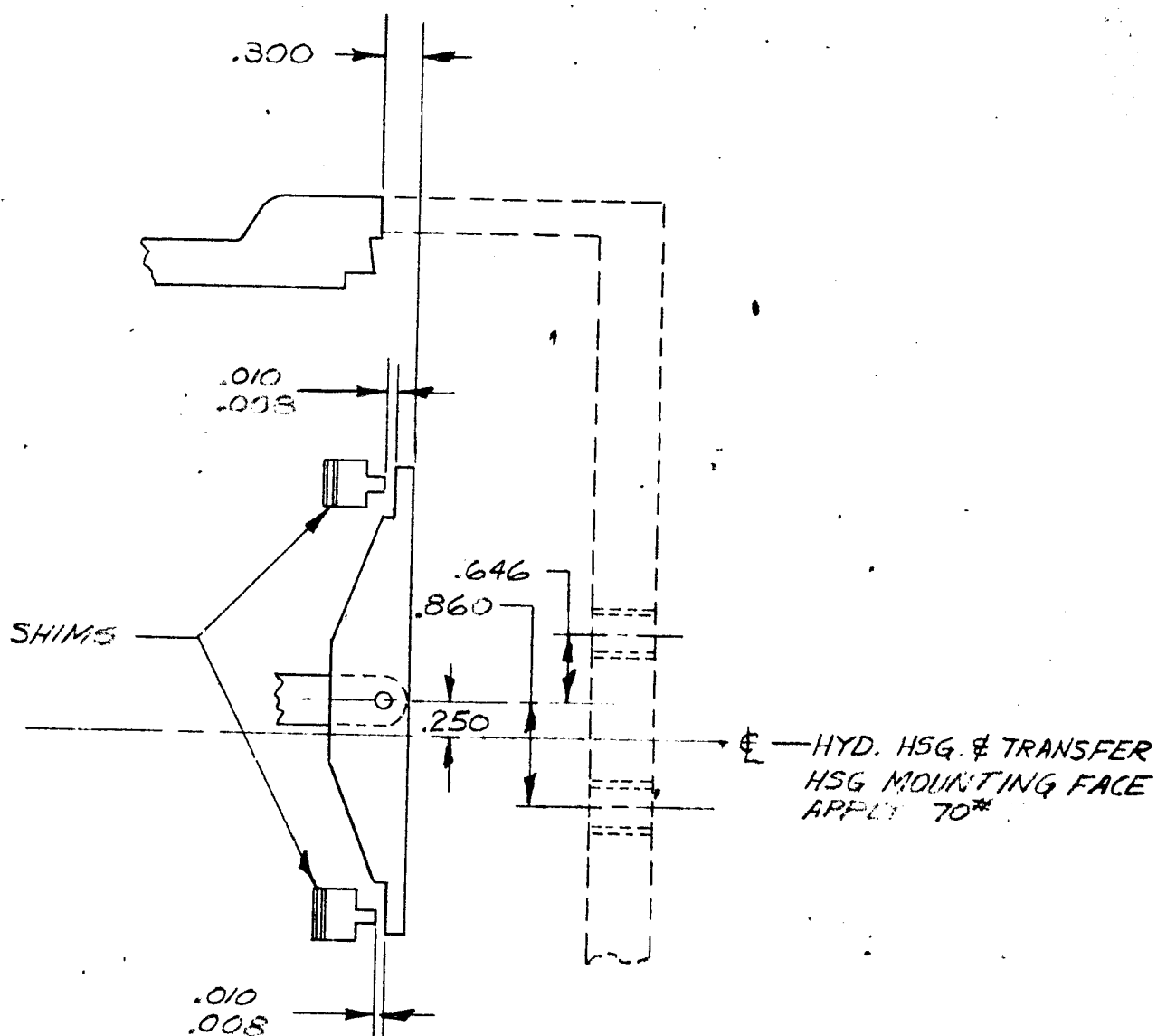


SHIM UNDER SPACER  
560213 WITH SHIMS  
513029 UNTIL A=B

FIGURE 10

Spec. No. HS 1509 D  
Page 39 of —  
CODE 73030

L-7203-23 ZONE II TRANSFER



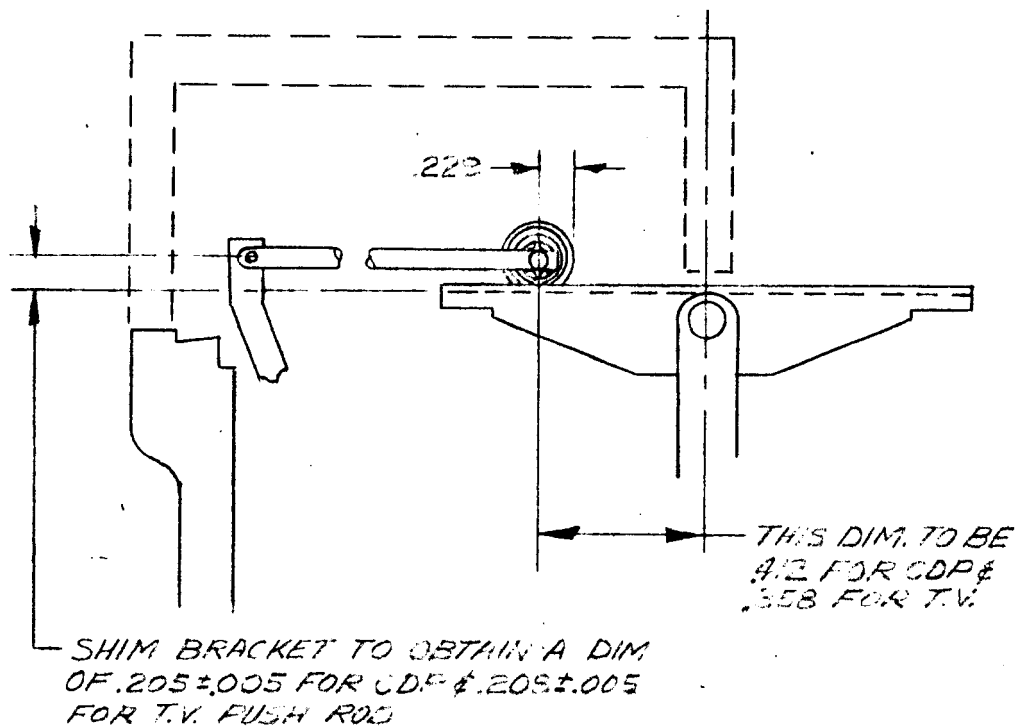
SHIM UNDER NOZZLES TO OBTAIN .008-.010 GAP

FIGURE 10

FIGURE 11

Spec. No. HS 1509 D  
Page 40 of —  
CODE 73030 —

# ZONE II TRANSFER



## NOTE:

WHEN SETTING PIVOT TO ROLLER DIM., SET CDP SYSTEM SUCH THAT THE 3-D CAM BALL FOLLOWER IS IN THE 30 PSIA DETENT FOR CDP ROLLERS AND SET TV.014 OPEN WHEN SETTING T.V. ROLLERS

REV. 5-18-62  
FIGURE 11

**Hamilton Standard**

DIVISION OF UNITED AIRCRAFT CORPORATION

WINDSOR LOCKS, CONNECTICUT • U.S.A.

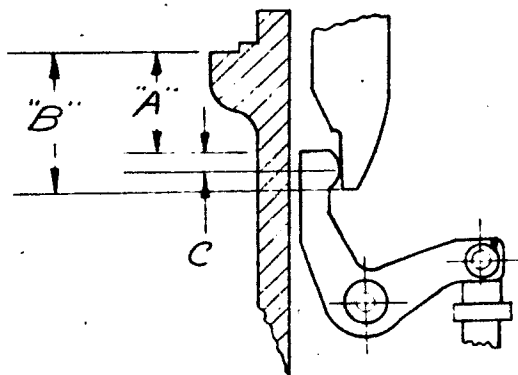
U  
A

SPEC. NO. HS 1509 D

CODE IDENT. NO. 73030

PAGE 41 OF

# TRANSFER LINKAGE



SHIM UNTIL DIM "B" IS EQUAL TO OR  
GREATER THAN DIM "A" + "C"

FIGURE 12

L-7208-28 T<sub>12</sub> SERVO

Spec. No. HS 1509 D

Page 42 of —

CODE 73030

ADJUST POSITION OF ROLLERS SO THAT AT  
PISTON POSITION FOR  $-65^{\circ}\text{F}$  DIM. "A" = "B" - "X" - .745  
DIM. "B" TO BE DETERMINED DURING INSP.

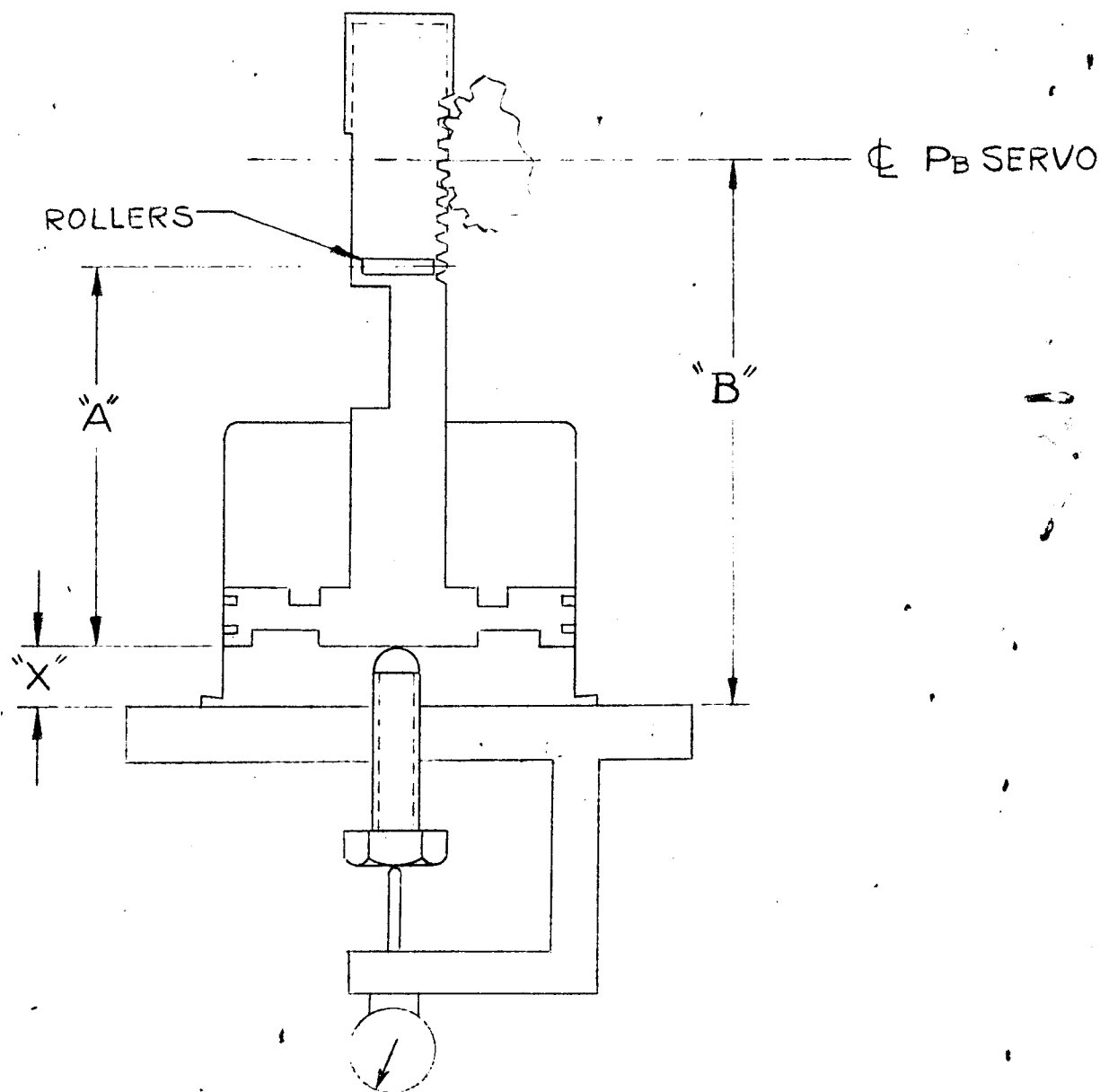


FIGURE 13.

HS F-788.1B 6/82

**Hamilton Standard**

DIVISION OF UNITED AIRCRAFT CORPORATION

WINDSOR LOCKS, CONNECTICUT • U.S.A.

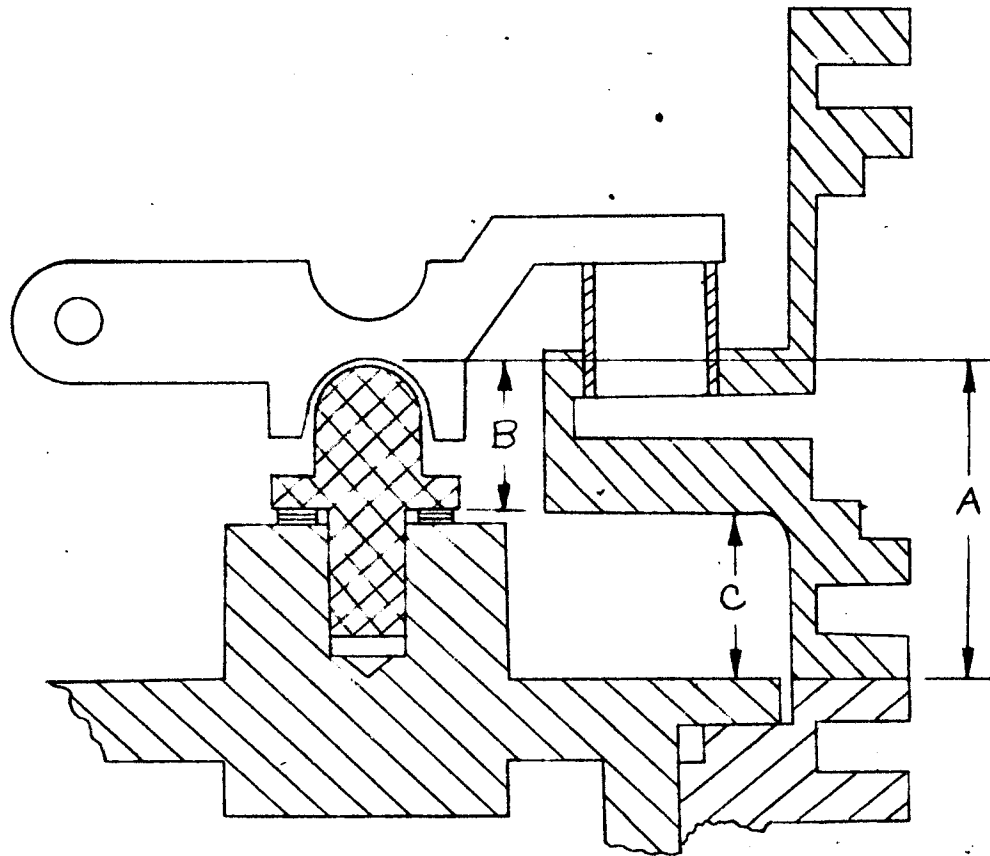
U  
A

SPEC. NO. HS 1509 D

CODE IDENT. NO. 73030

PAGE 43 OF

JFC-51  
SHIMMING PROCEDURE  
PRESS. REG. VALVE  
SENSOR



# SHIMMING

SHIM USED	REQ'D SHIM THICKNESS	SHIM ACT.	ASS'Y	INSP
515295	$X = [A - (B + C)] + .015$			

FIGURE 14



**Hamilton Standard**  
WINDSOR LOCKS, CONNECTICUT • U.S.A.

DIVISION OF UNITED AIRCRAFT CORPORATION

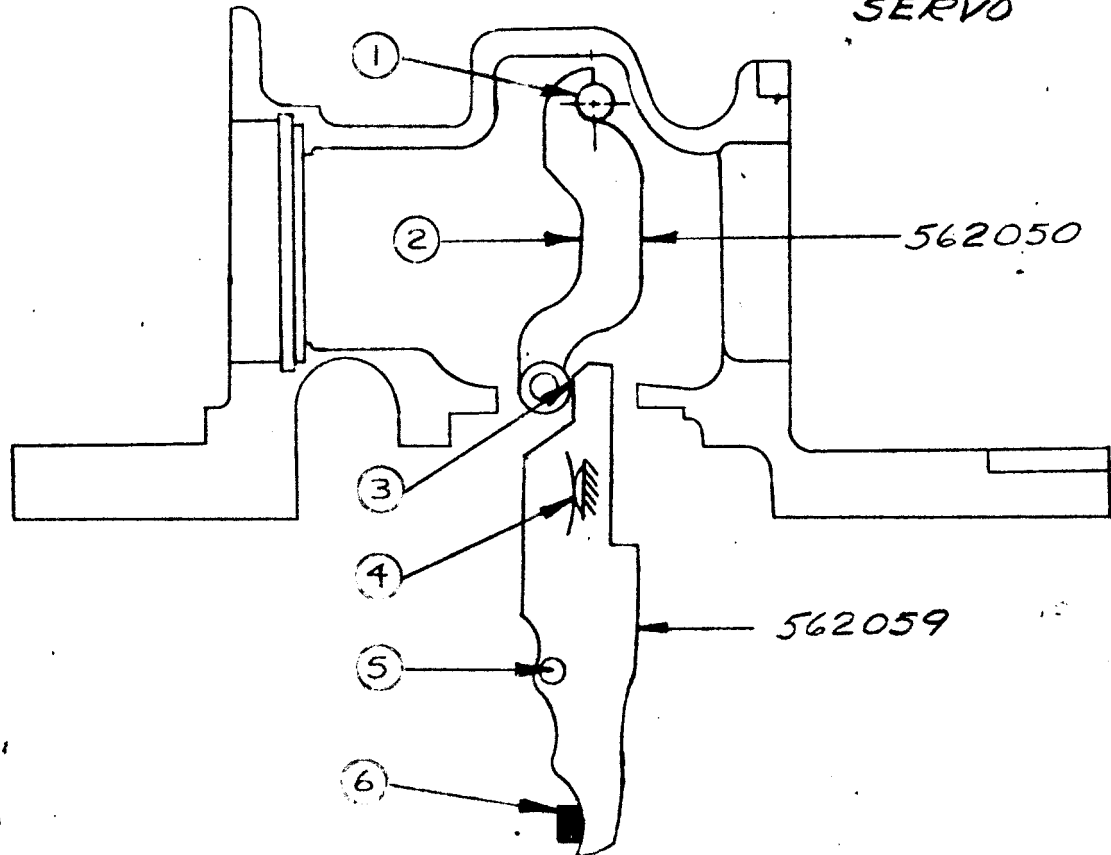
U  
A

SPEC. NO. HS 1509 D

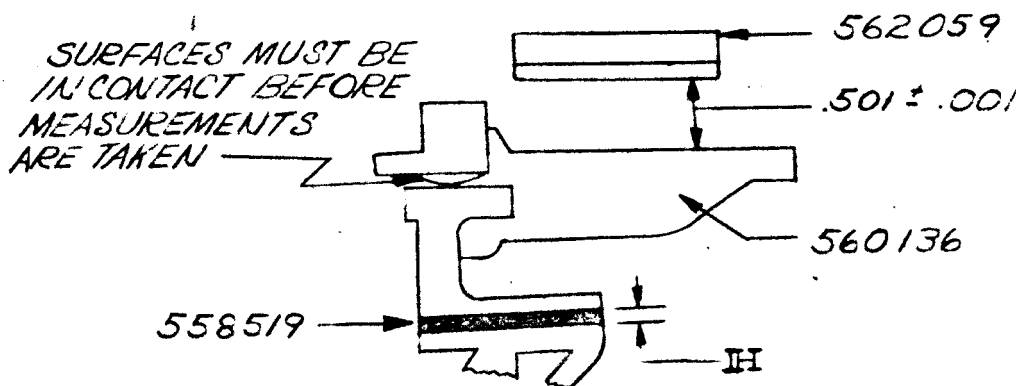
CODE IDENT. NO. 73030

PAGE 44 OF

# TEMPERATURE SENSING SERVO



SET UP LEVERS 562050 AND 562059  
TO BE IN LINE AT POINTS ①, ②, ③, ④, ⑤ AND ⑥



WITH 562059 SET  
AT ABOVE POSITION  
ADD SHIM 558519  
UNDER BRACKET  
560138 SO THAT  
.501 DIM IS OBTAINED  
WHEN LEVER 562059  
AND LEVER 560138  
ARE PARALLEL

SHIM NOZZLES FOR  
.003 NULL GAP

FIGURE 15

Spec. No. 1107 D  
Page 25 of  
CODE 73030

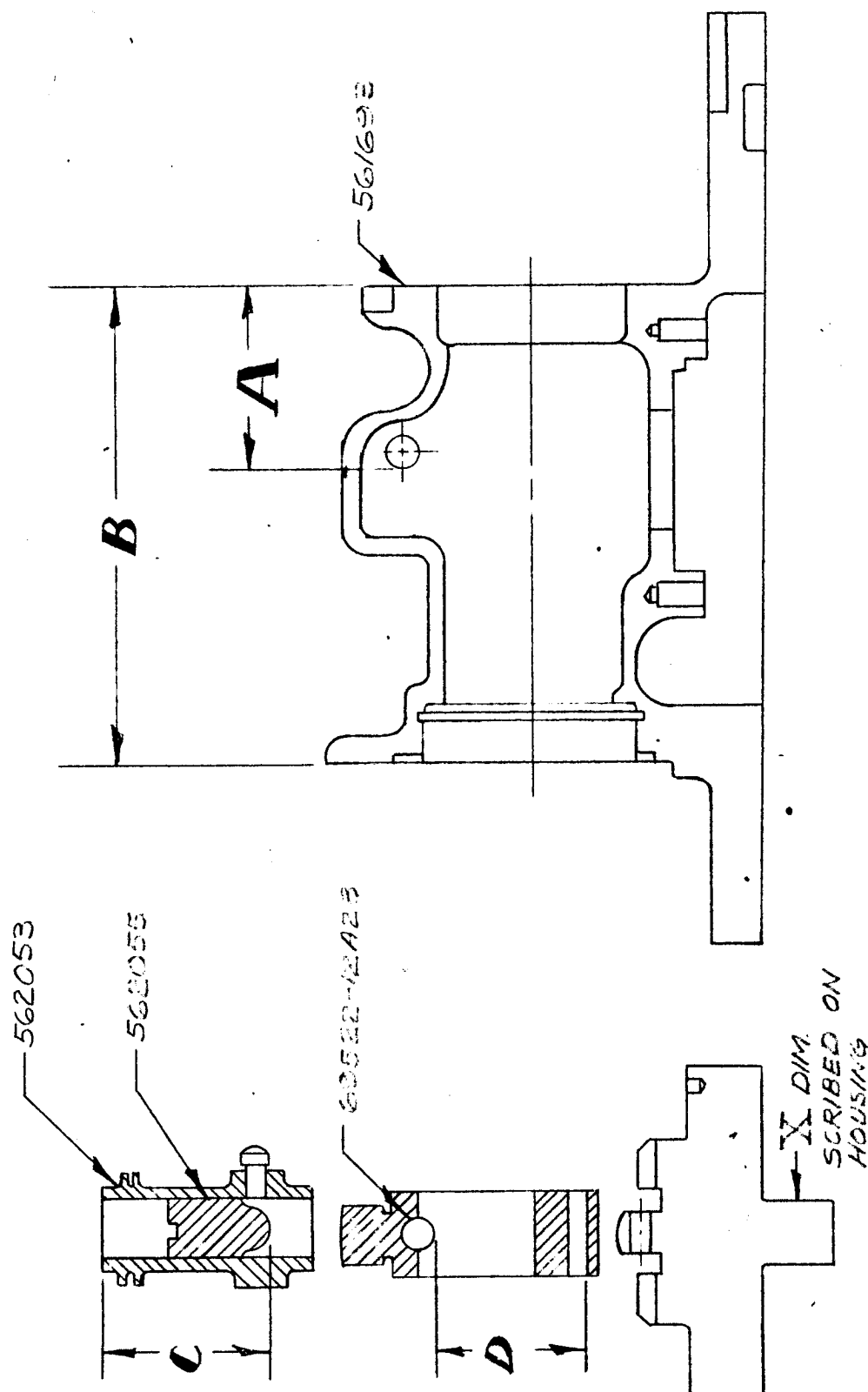


FIGURE 16

HS F-788.1B 6/62

**Hamilton Standard**

DIVISION OF UNITED AIRCRAFT CORPORATION

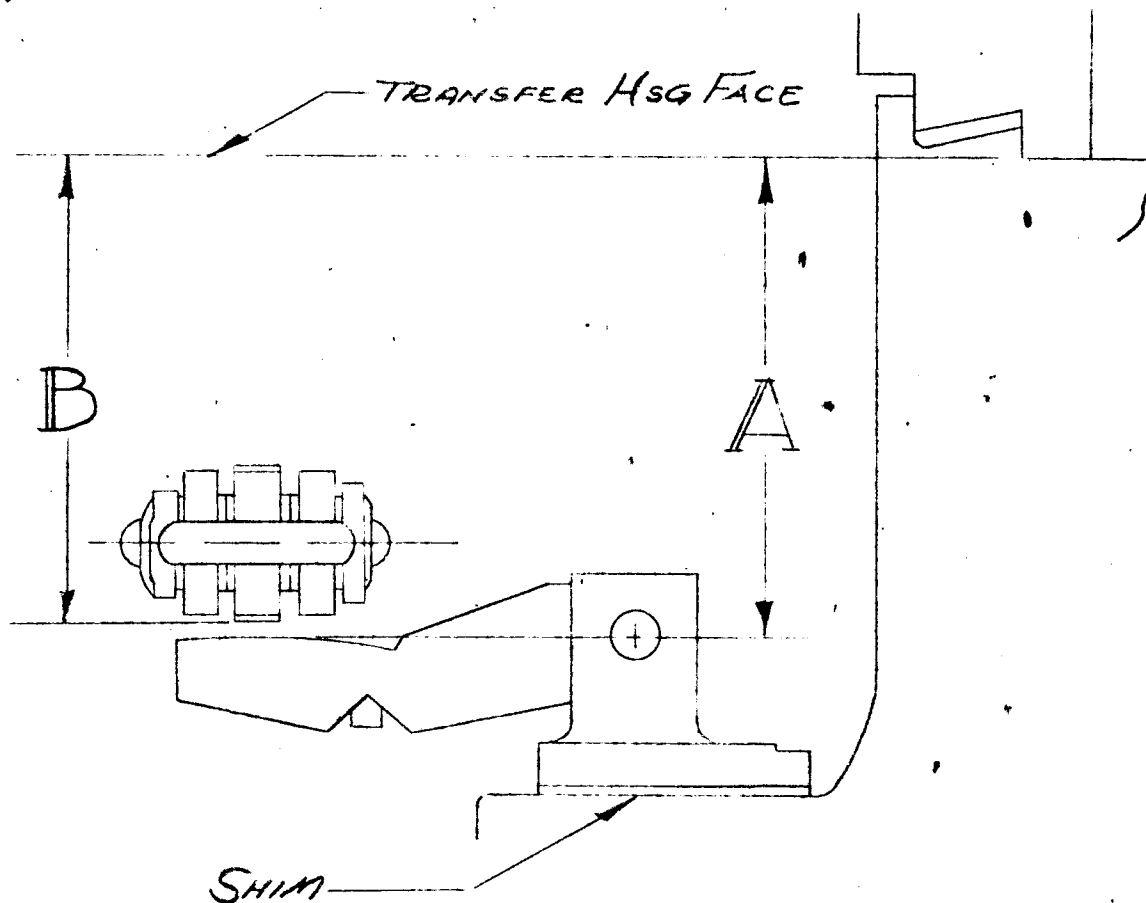
WINDSOR LOCKS, CONNECTICUT • U.S.A.

U  
A

SPEC. NO. HS 1509 D

CODE IDENT. NO. 73030

PAGE 48 OF



$$\underline{\text{SHIM THICKNESS}} = A - B \pm .002$$

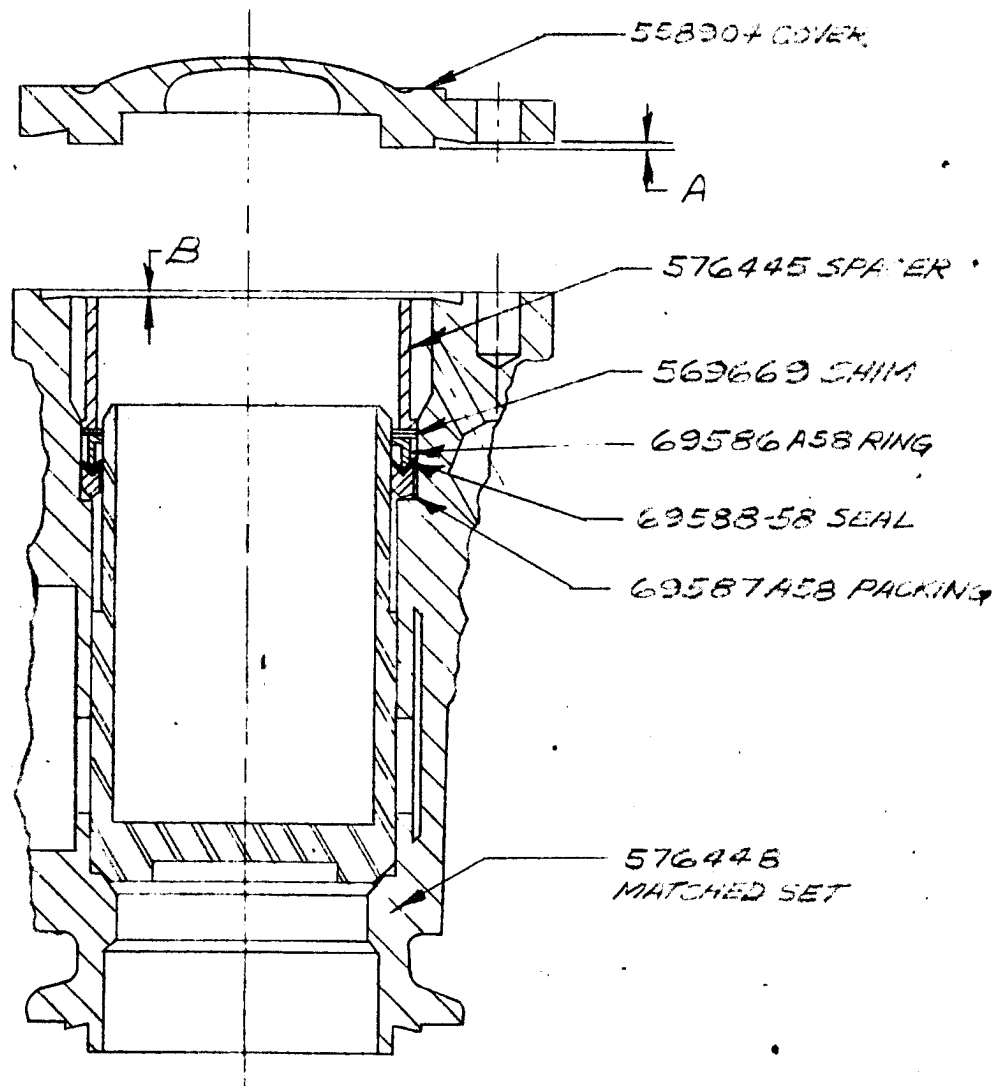
REV 5-5-62  
FIG-19

H.S. Spec. 1509 D

Page 47 of

Code 73030

*SHIM INSTRUCTION FOR ZONE-I*



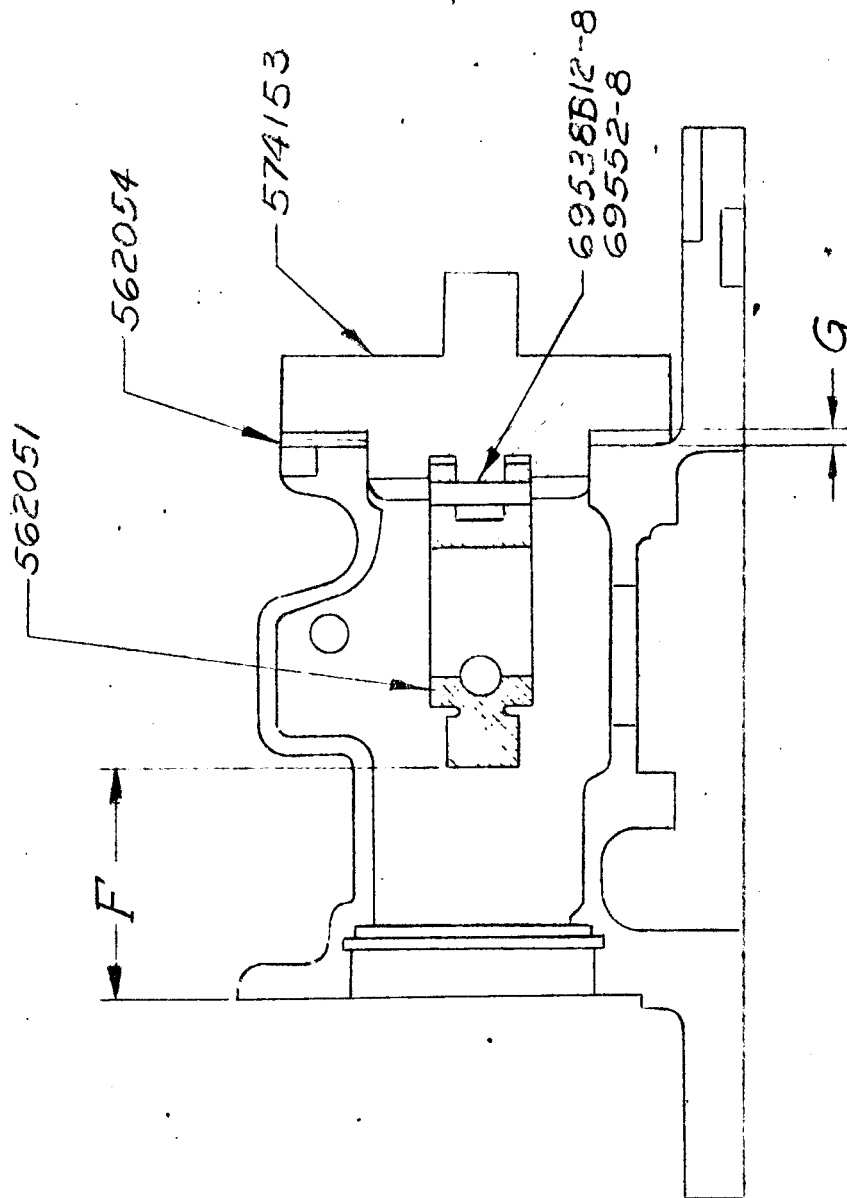
$$SHIM = B - A - (.002 \text{ TO } .004)$$

FIGURE 18

FIGURE 17

# TEMPERATURE SENSING SERVO

Spec. No. HS 1509 D  
Page 46 of —  
CODE 73030



NO CHIM "G" 562054. =  $[X + D - .130] - A \pm .001$   
"C" DIM. = "F" - .300

FIGURE 17

HS F-788.1B 6/62

**Hamilton Standard**

WINDSOR LOCKS, CONNECTICUT • U.S.A.

DIVISION OF UNITED AIRCRAFT CORPORATION

U  
A

SPEC. NO. HS 1509 D

CODE IDENT. NO. 73030

PAGE 49 OF

*C.D.P. SENSOR & OUTPUT LEVER*

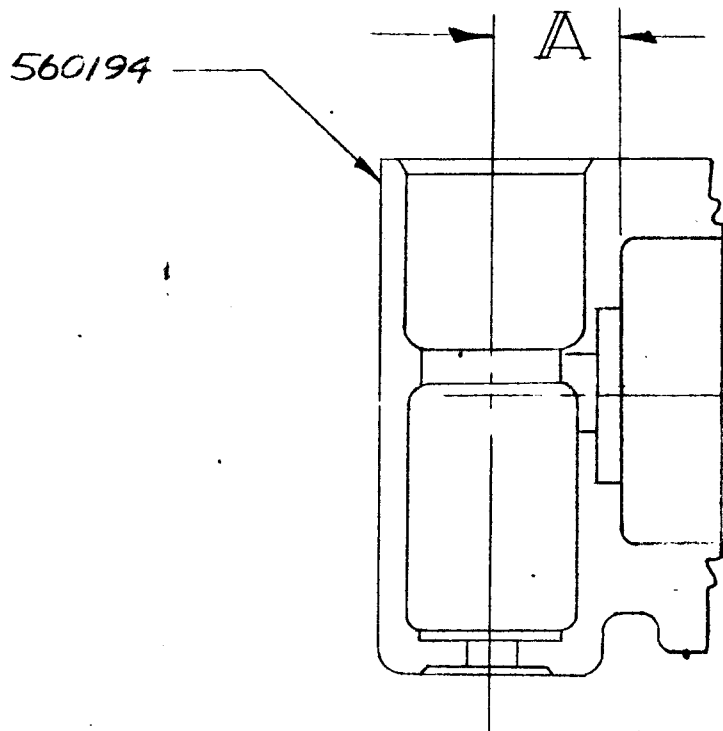


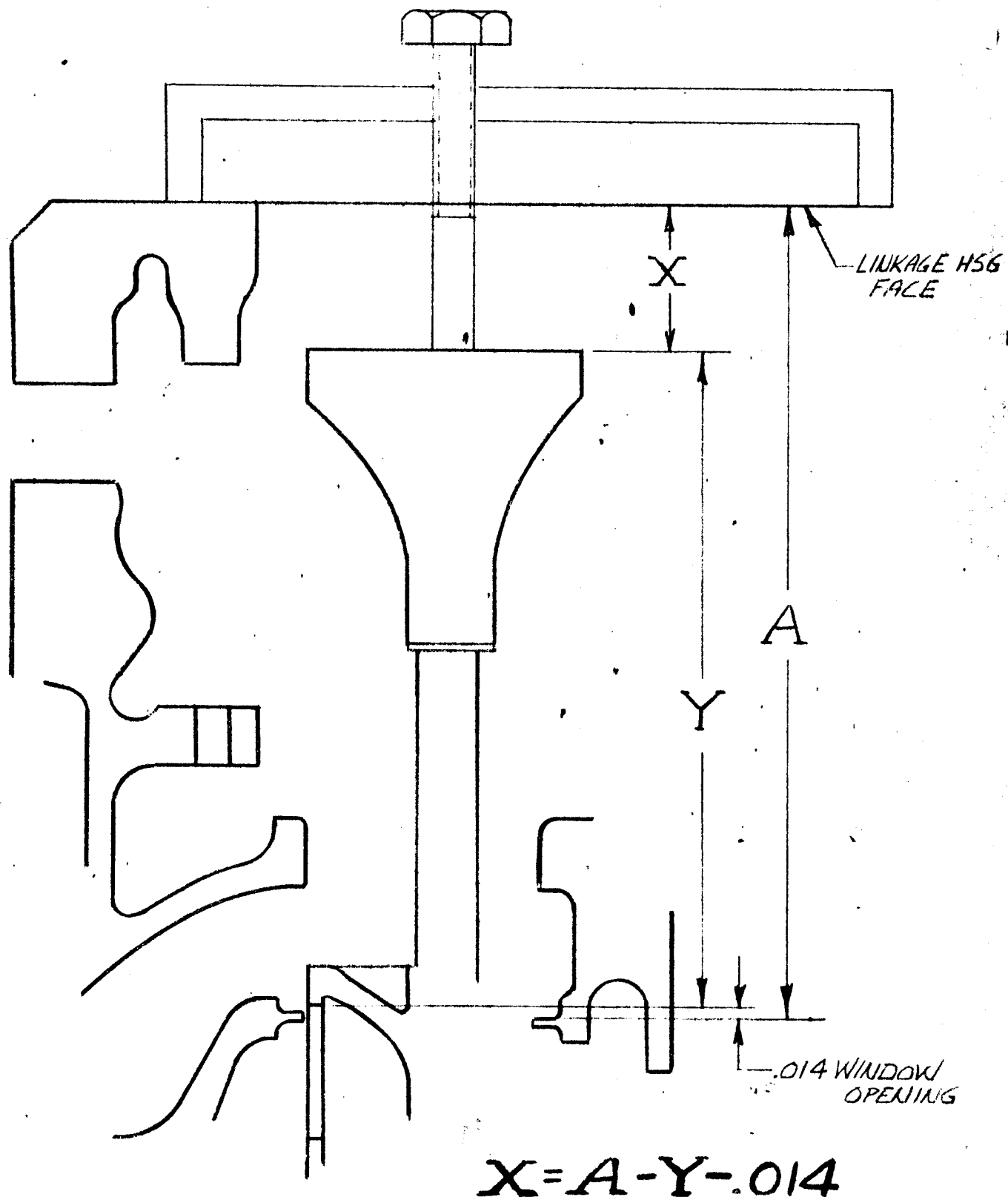
FIG. 20

L-1203-23 TRANSFER ROLLER  
SHIMMING PROCEDURE

FIGURE 22

Spec. No. H31509 D

Page 50 of —



$$X = A - Y - .014$$

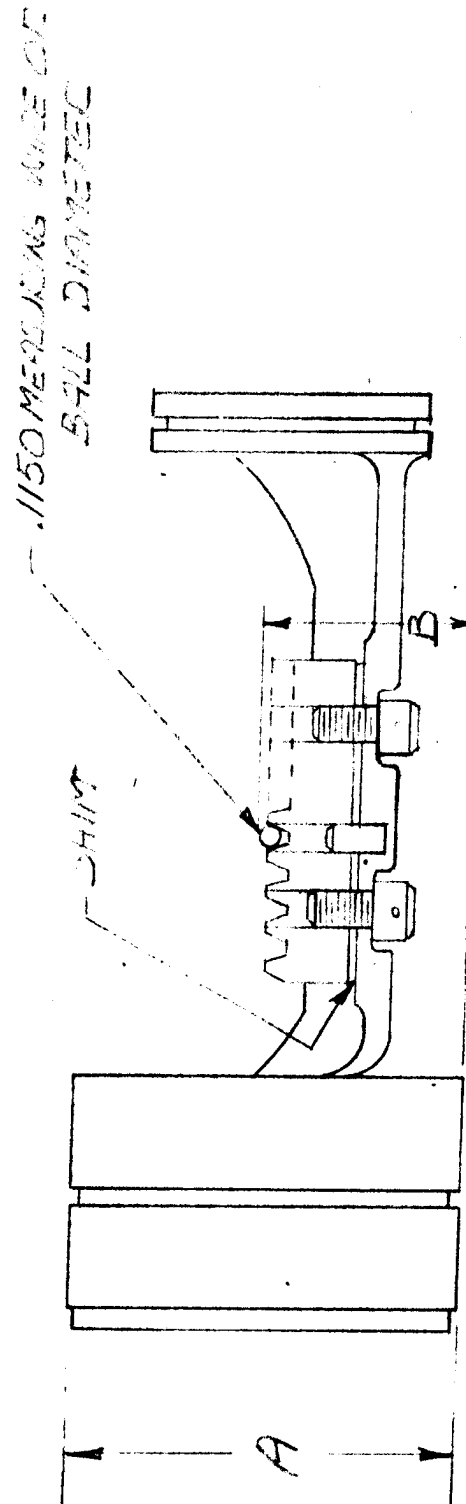
FIG. 22

FIGURE 23

Spec. No. HS 1509 D

Page 51 of

L-7203-112 TWO PIECE PUMP CONTROL POWER PISTON

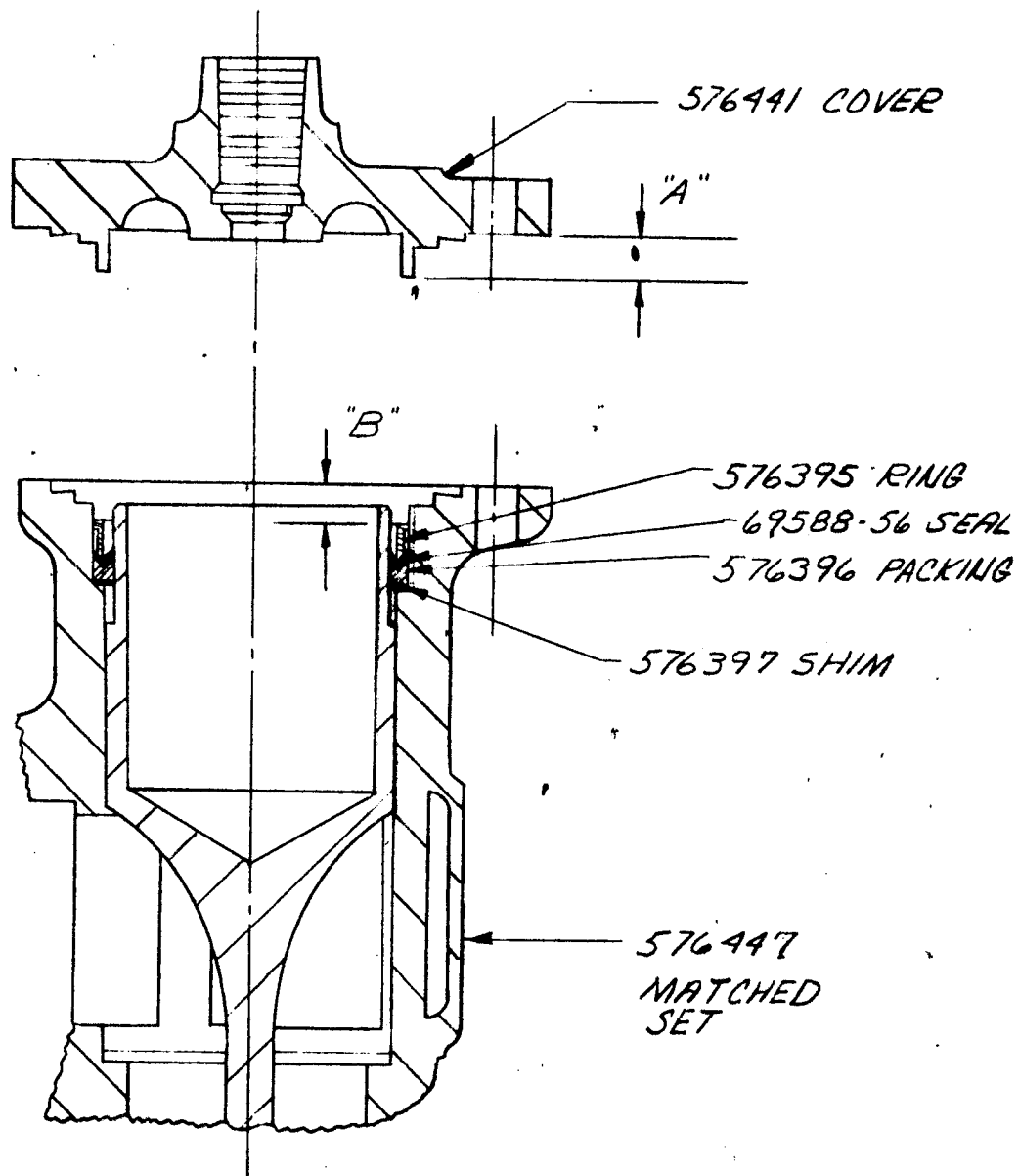


$$SHIM = \left( \frac{B}{2} + 0.068 \right) - B \pm .001$$

FIG. 23



*SHIM INSTRUCTIONS FOR ZONE II*



$$SHIM = B - A - (.002 \text{ TO } .004)$$

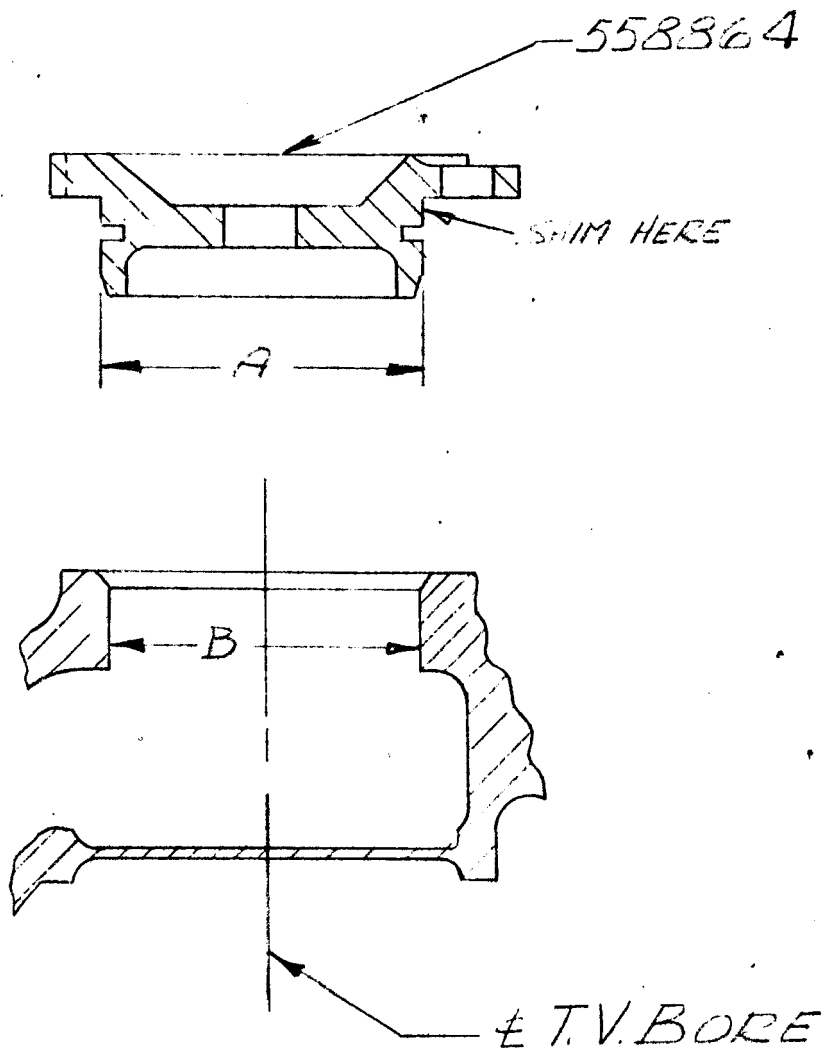
FIGURE 24

HS F-755.1 8/54

HAMILTON STANDARD  
DIVISION OF UNITED AIRCRAFT CORPORATION  
WINDSOR LOCKS, CONNECTICUT, U. S. A.

HS SPEC No 1509 D  
Page 53 of

T.V. COVER



$$\text{SHIM THICKNESS} = \frac{B-A}{2}$$

USE SHIM 57412B

FIG. 25

HS F-755.1 8/54

HAMILTON STANDARD  
DIVISION OF UNITED AIRCRAFT CORPORATION  
WINDSOR LOCKS, CONNECTICUT, U. S. A.

HS SPEC No 1509 D  
Page 54 of

FIGURE 26

# L-7208-13 CBA LINKAGE

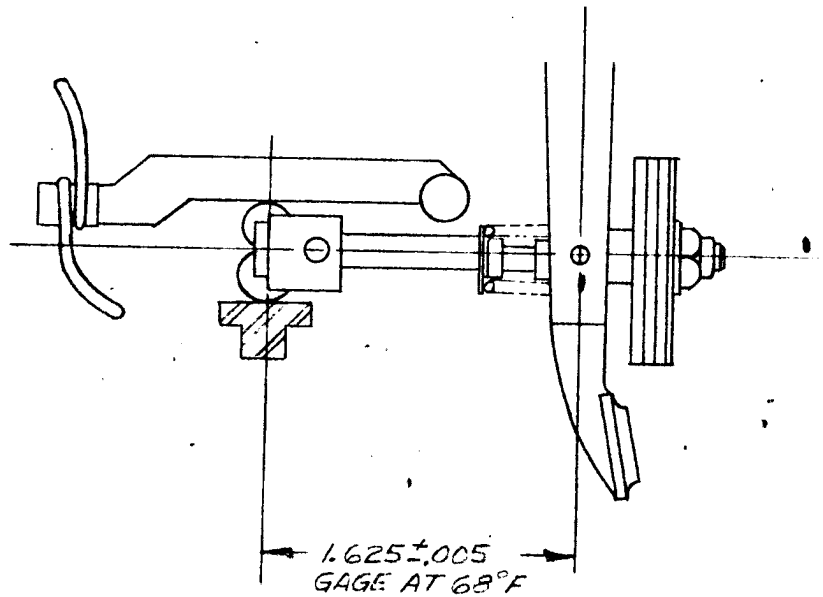


FIGURE 26

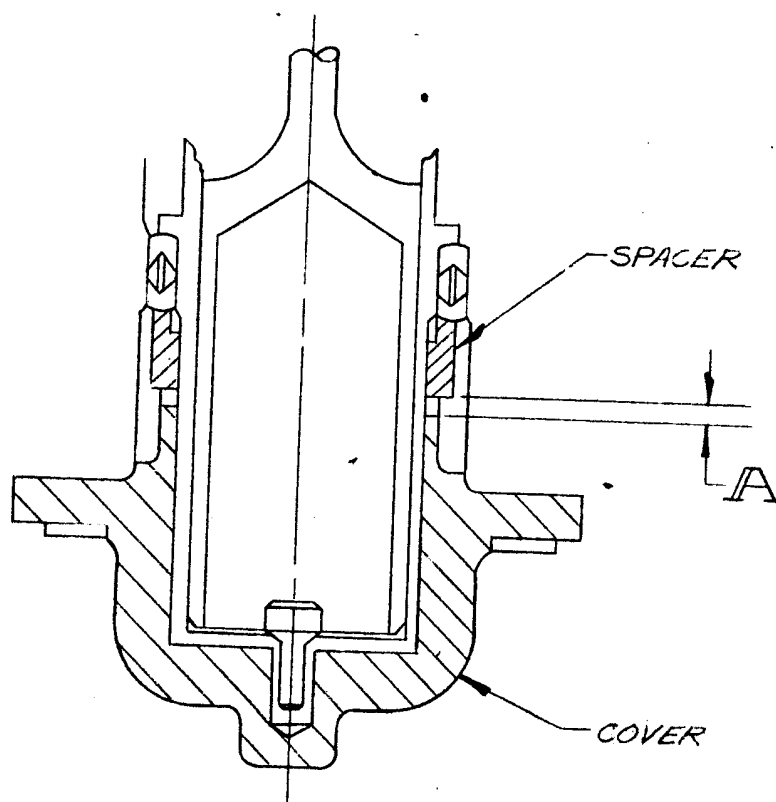
HS F-755.1 8/54

HAMILTON STANDARD  
DIVISION OF UNITED AIRCRAFT CORPORATION  
WINDSOR LOCKS, CONNECTICUT, U. S. A.

HS SPEC NO 1509 D  
Page 55 of

FIGURE 27

L-7208-96R  
PEAK VALVE SLEEVE AND CHEVRONS



"A" = .003 = AMOUNT OF SHIMS BETWEEN SPACER & COVER

FIGURE 27

FIGURE 28

Spec. No. HS 1509 D  
Page 56 of —  
CODE 73030

JFC-51  
THROTTLE VALVE LINKAGE

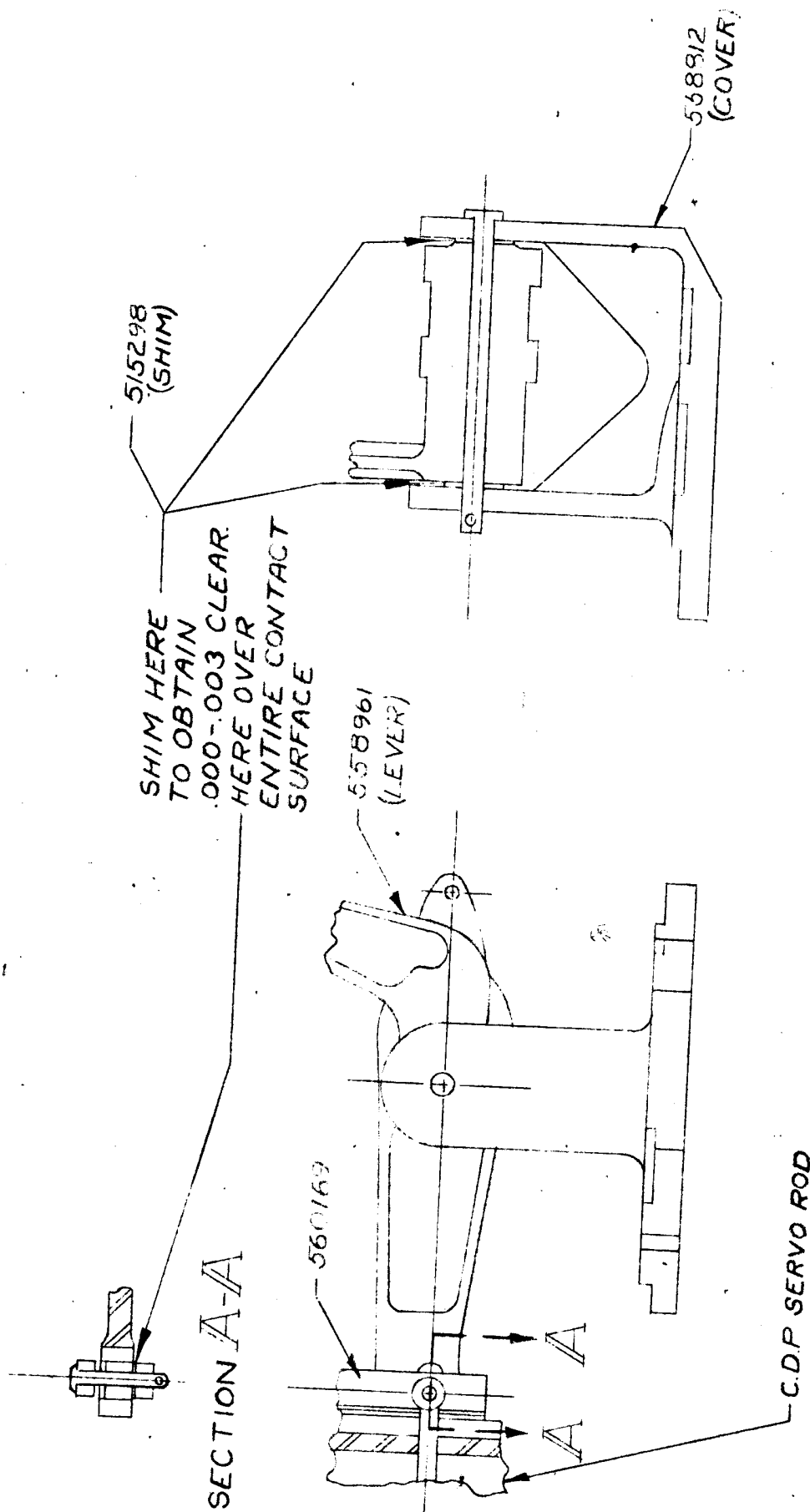
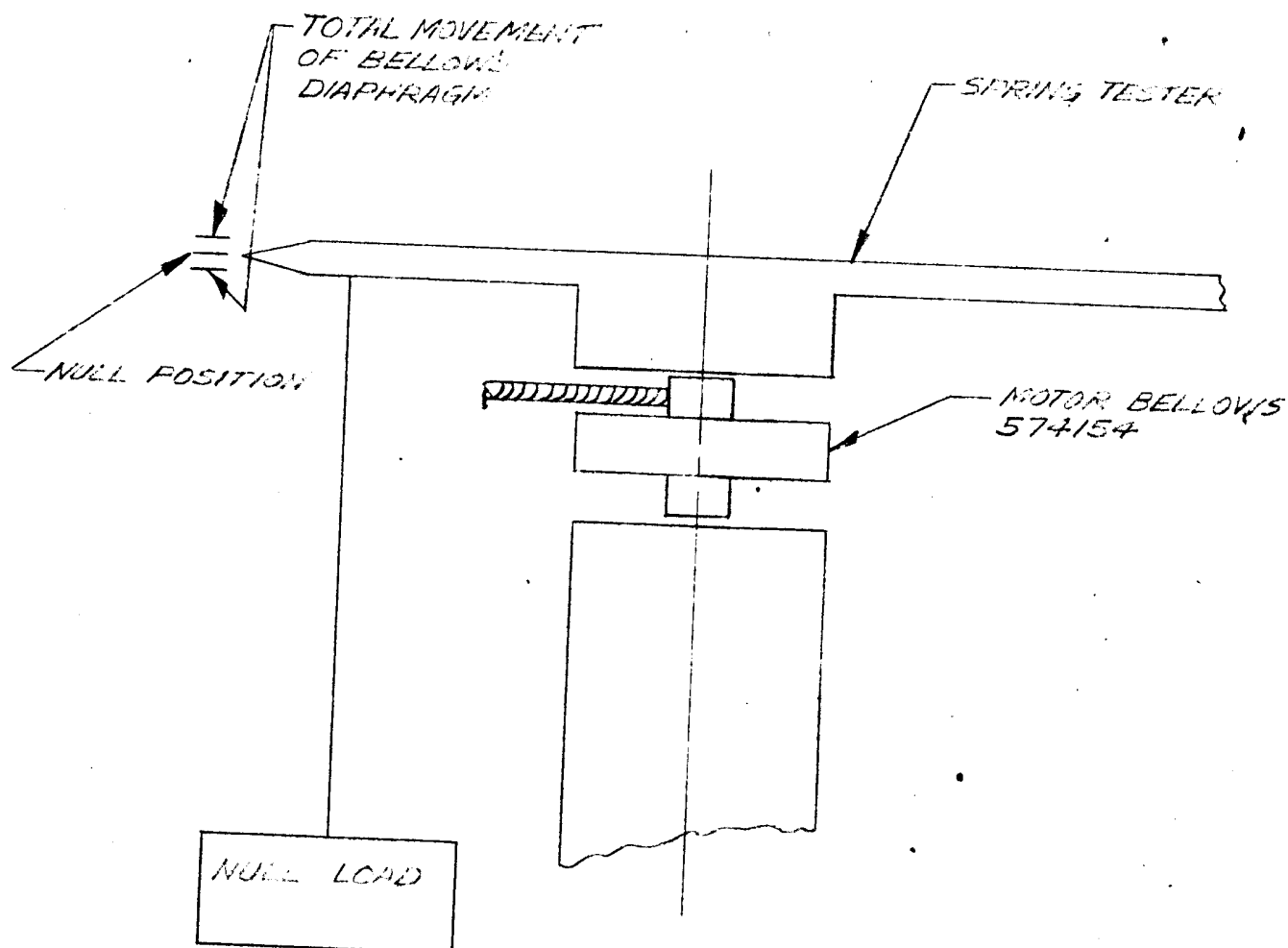


FIGURE 25

H.S. Spec. 1509 D  
Page 57 of  
Code 73030

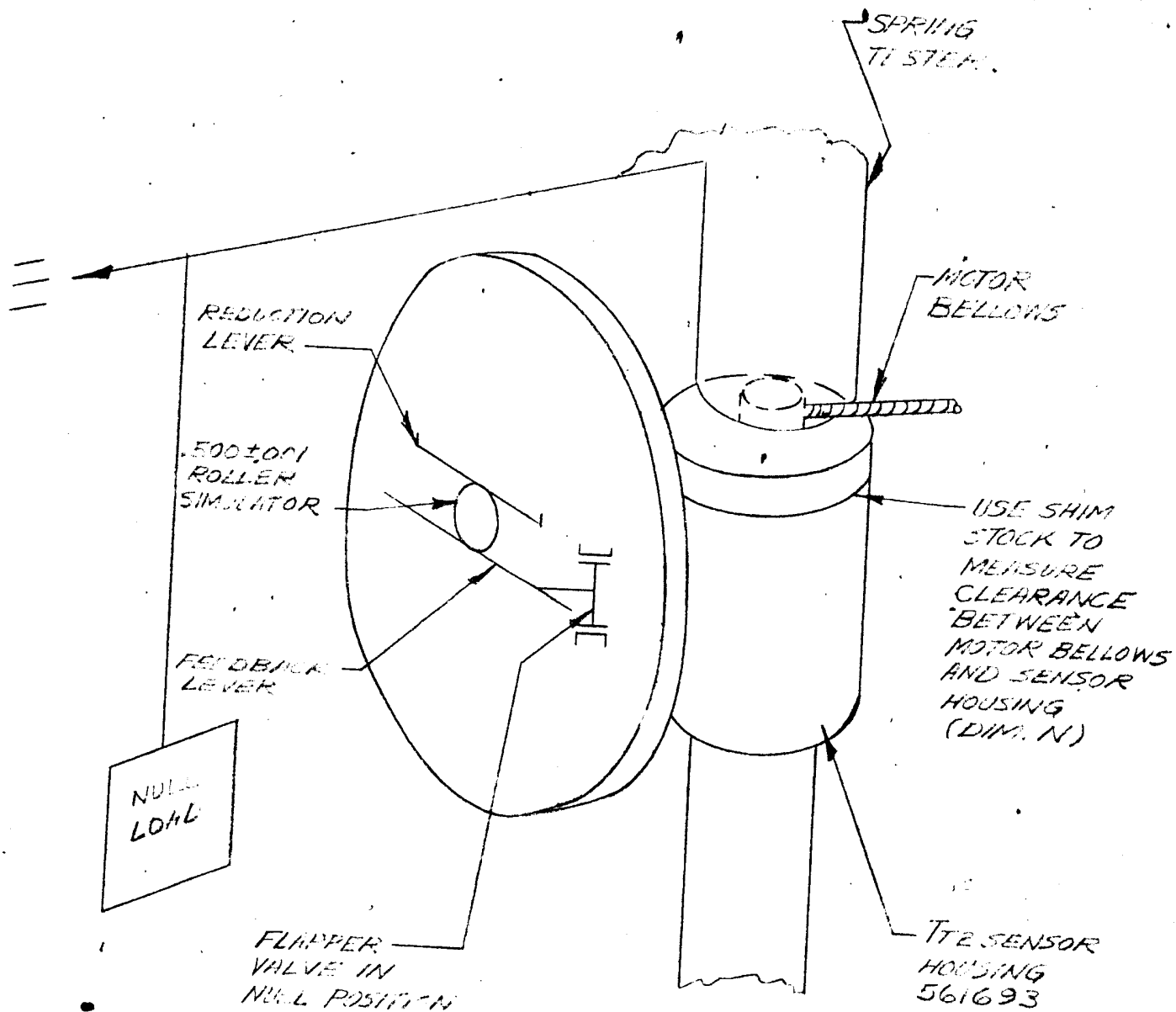


DETERMINATION OF MOTOR BELLOWS  
NULL LOAD

FIGURE 29

FIGURE 30

H.S. Spec. 1509 D  
Page 58 of —  
Code 73030 —



DETERMINATION OF DIM. N  
FOR SCREW 561693 SETTING

HS 1509 D  
Page 59  
Fig. 31  
CODE 73030

ASSEMBLY - PUMP CONTROL

Sensor Piston

Obtain dimension A on Servo Piston (1)

Dimension A = \_\_\_\_\_

Utilizing fixture 568400 T-81

Obtain Dimension B on Pump Control

Housing Bore for Servo Piston

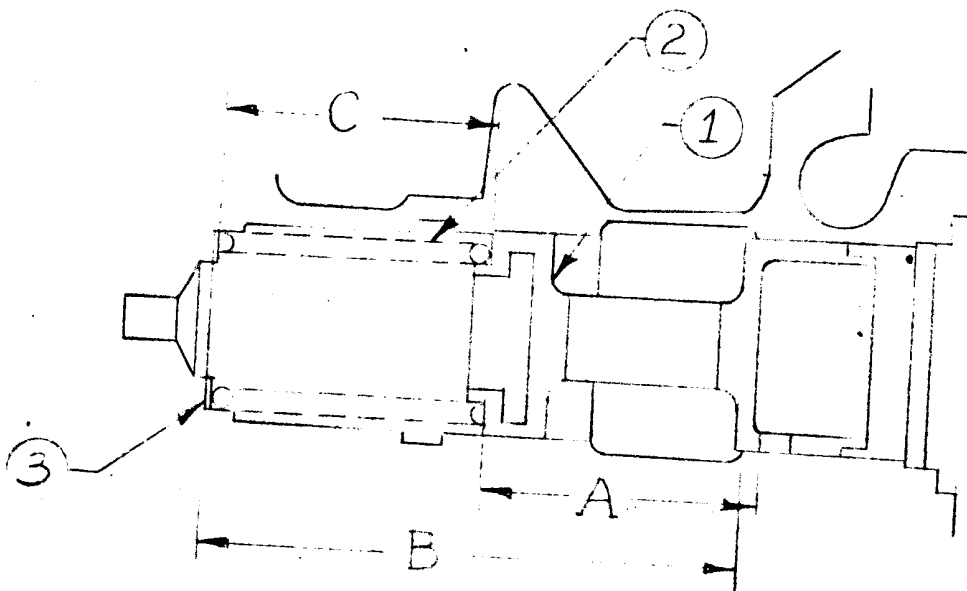
Dimension B = \_\_\_\_\_

Measure height of Sensor Piston Spring (2) with a 24 lb load applied to spring

Dimension C = \_\_\_\_\_

Shim thickness =  $(B + .080) - (A \text{ \& } C)$

Shim under Sensor Piston Spring with Shim (3)





HS F-75L 1B 6/62

**Hamilton Standard**  
WINDSOR LOCKS, CONNECTICUT • U.S.A.

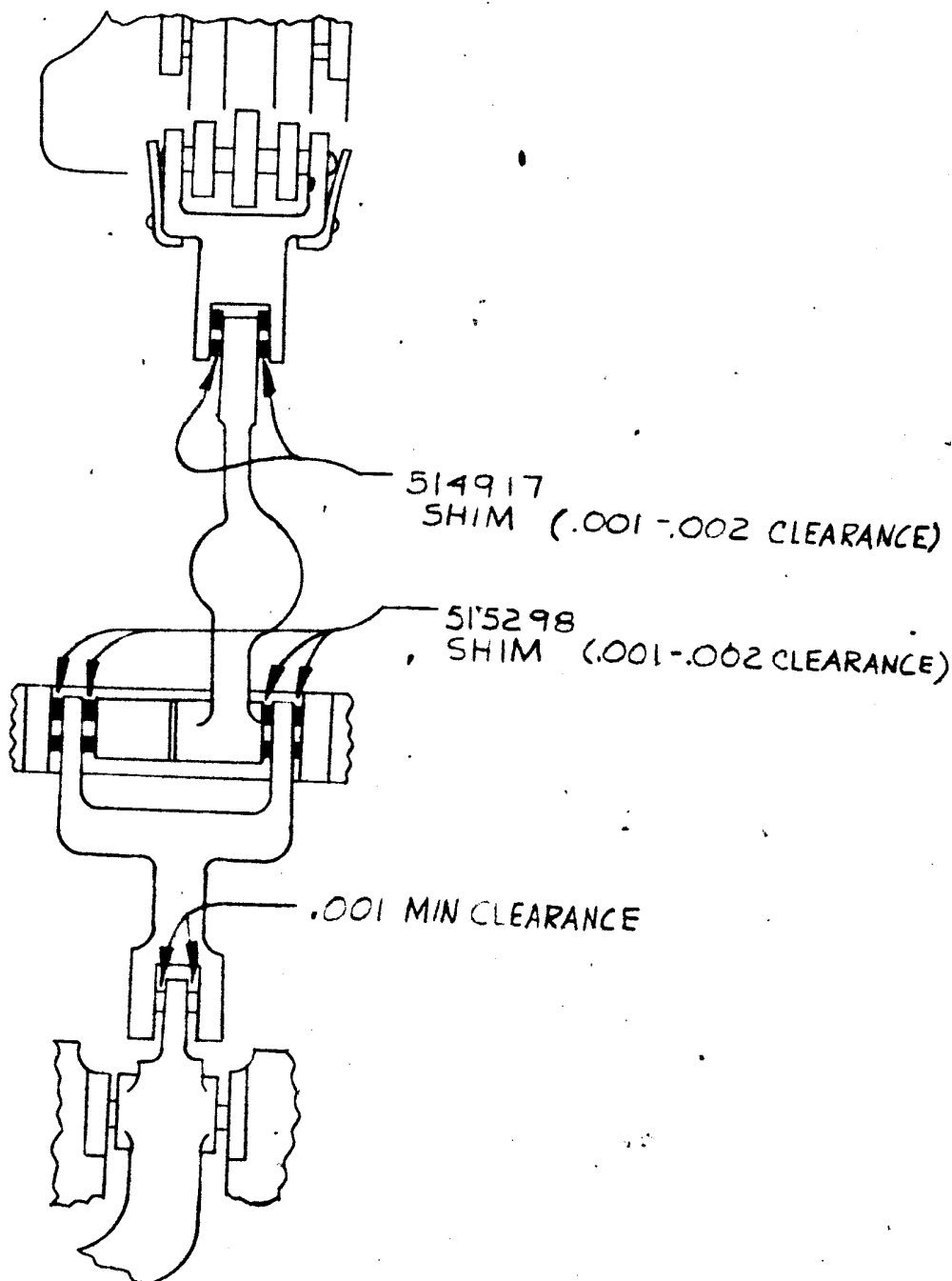
DIVISION OF UNITED AIRCRAFT CORPORATION

**U  
A**

SPEC. NO. HS 1509 D

CODE IDENT. NO. 73030

PAGE 60 OF



C.P.D. LINKAGE

5-18-62  
FIGURE 32

HS P-788.1B 6/62

**Hamilton Standard**

WINDSOR LOCKS, CONNECTICUT • U.S.A.

DIVISION OF UNITED AIRCRAFT CORPORATION

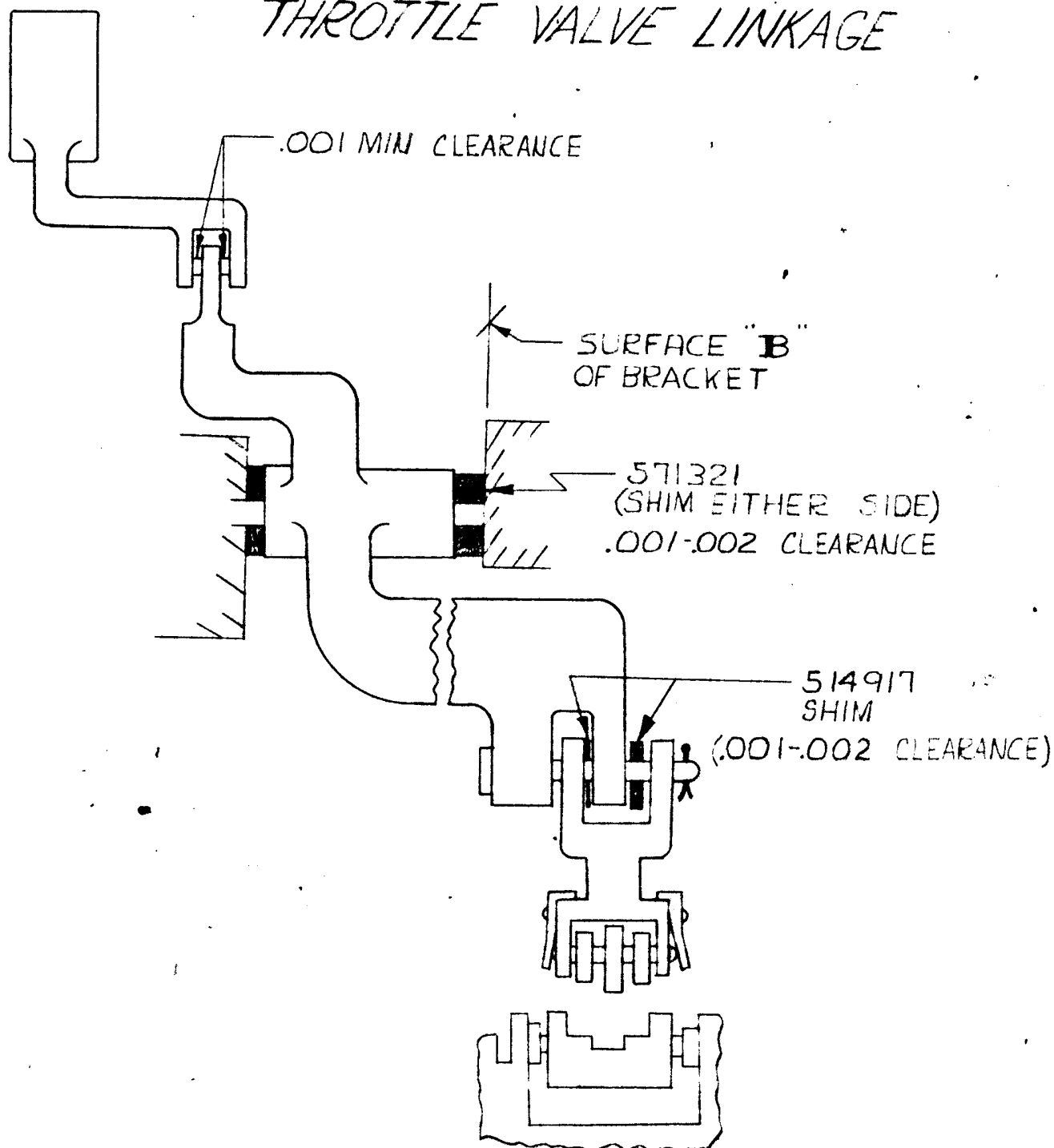
**U  
A**

SPEC. NO. HS 1509 D

CODE IDENT. NO. 73030

PAGE 61 OF

# THROTTLE VALVE LINKAGE



5-18-62  
FIGURE 33